

PELVIS

2008-09

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PELVIS

2008-2009

①

- The pelvis is divided into two parts; pelvic wall and pelvic cavity

PELVIC WALL

- Pelvic wall consists of

- ① **BONES** :- two hip bones (anterolateral).
 - Sacrum & coccyx (posteriorly).
- ② **JOINTS** :- Symphysis pubis, sacroiliac and sacrococcygeal joints.
- ③ **LIGAMENTS** :- Sacrotuberous, sacrospinous & joint ligaments.
- ④ **MUSCLES** :- obturator internus, piriformis,
 - Coccygeous & levator ani muscles.
- ⑤ **MEMBRANES** :- Perineal & obturator membranes.

- Pelvic walls are: anterior, posterior, lateral & inferior walls.

(I) ANTERIOR PELVIC WALL :- (shallowest one)

- formed of : 1- Pubic bodies (posterior surface).
- 2- Pubic rami,
- 3- Symphysis pubis.

(II) POSTERIOR WALL :- (extensive),

- formed of : 1- Sacrum & coccyx.
- 2- Piriformis muscle & pelvic fascia.

(III) LATERAL WALL :-

- formed of : 1- Part of hip bone (below pelvic inlet).
- 2- Sacrospinous & sacrotuberous ligament.
- 3- obturator membrane.
- 4- obturator internus ms & it's fascia

(IV) INFERIOR WALL :- (support pelvic viscera):

- formed of :- pelvic diaphragm which consists of :-
 - 1- Levator ani muscle.
 - 2- Coccygeous muscle.
 - 3- Their covering fascia.
- inf. wall (pelvic floor) divided pelvis into main pelvic cavity (above it) and perineum (below it).

* PARTS OF PELVIS

- Pelvis is divided into true (lesser) & false (Greater) pelvis:

-I- True pelvis :-

- Between pelvic inlet (brim) & pelvic outlet.
- In female it forms bony canal for child birth.

-II- False pelvis :-

- Cavity above pelvic inlet.
- forms part of abdominal cavity & support it's contents.
- Supports gravid uterus (after 3rd month) & helps to guides fetus into true pelvis during labour.
- Boundaries are • 1- Lumbar vertebrae (behind).
 - 2- Iliac fossae & iliacus ms (laterally).
 - 3- ant. abdominal wall "lower part" (front).

* Pelvic inlet (brim) :-

- Pelvic brim is bounded by :-
 - Sacral promontory & ala (Posterior).
 - Iliopectineal line (Laterally).
 - Pubic crest & symphysis pubis (ant.)

* Pelvic outlet :-

- Diamond shaped, bounded by :-
 - Symphysis pubis (ant. angle).
 - Tip of coccyx (Post angle).
 - Lateral angles (ischial tuberosity).
 - Pubic arch (anterolateral side).
 - Sacrotuberous lig. (PosteroLat. side).

BONES OF PELVIC WALL

* SACRUM :-

- Wedge shaped bone, consists of 5 fused vertebrae.
- Articulate above with L₅ vertebra & below with coccyx, articulates laterally with ileum forming sacroiliac joint.
- Sacral promontory is the upper ant. margin of 1st sacral vertebra (forms post. margin of pelvic inlet).
- Sacral canal is the fused vertebral foramina.
Contents are:- 1- Cauda equina ----- (sacral & coccygeal spinal nerves) "ant & post roots"
2- Filum terminale.
3- Fibro fatty material & vein plexus.
4- Lower part of subarachnoid space (upto S₂).
- Sacral hiatus :- is the lower foramen behind lower end of sacrum (due to failure of fusion between laminae of S₄ and S₅ vertebrae in midline).
Contents are:- 1- S₅ spinal nerve (right & left).
2- Coccygeal spinal nerves (right & left).
3- Filum terminale.
- Sacral foraminae are anterior (for passage of ant. rami of upper 4 sacral nerves & lateral sacral vessels) and posterior foramina (for post. rami of upper 4 sacral nerves).
- Lumbosacral angle is the angle between L₅ vertebra & sacrum, it is tilted forward.

* COCCYX :

- Triangular bone formed of 3 or 4 fused vertebrae.
- articulate with it's base to apex of sacrum.
- Coccygeal vertebrae consists only of bodies, but the 1st one has rudimentary transverse process & cornua (remains of pedicles & superior articular processes).

***HIP BONE :-**

- The hip bone (was called innominate bone) is formed of 3 fused bones -1- Ilium → superiorly.
- 2- Ischium → Postero-inferior.
- 3- Pubis → Antero-inferior.

(1) Ilium :-

- The upper flat part of hip bone.
- Consists of - 4 iliac spines
 - Anterior superior iliac spine (ASIS).
 - Anterior inferior " " (AIIS).
 - Posterior superior " " (PSIS).
 - Posterior inferior " " (PIIS).
- Iliac crest between ASIS & PSIS.
- Outer surface & inner (ilac fossa) surface.
- Iliopectineal line (runs downward, forward).
- Auricular surface (articulate with sacrum).
- Articulate w sacrum (sacroiliac joint → synovial plane) [and the two pubic bodies forms symphysis pubis → 2nd cartil. joint]

(2) Ischium :-

- Consists of ischial spine, tuberosity & ramus.

(3) Pubis :-

- Consists of - pubic rami (superior & inferior).
- pubic body (having pubic crest & tubercle).

- *NB :-** Acetabulum is a depression at lateral surface of hip for articulation with head of femur forming hip joint (synovial ball & socket)
- Acetabulum represents union point of the 3 bones of hip forming Y shaped.
 - Obturator membrane covers obturator foramen leaving small gap "obturator canal" for passage of obturator nerve & vessels from pelvis to thigh.
 - Obturator foramen is a large opening at Lower part of hip (in pubis & ischium)

LIGAMENT OF PELVIS

* SACRO-SPINOUS LIG. :-

- Strong triangular Ligament.
- attached by apex to spine of ischium & base to lateral part of sacrum & coccyx.

* SACRO-TUBEROUS LIG. :-

- Strong, relatively inflexible ligament.
- attached by one side to ischial tuberosity & other to lower part of sacrum, coccyx & P.I.S.

*NB. Sacrospinous & sacrotuberous ligaments prevent lower end of sacrum & coccyx from being rotated upward by body weight & stabilize the pelvis.
 • In anatomical position ASIS & symphysis pubis lie in same vertical plane.

*NB. PELVIC DIAPHRAGM (floor) (= Levator ani + coccygeus) is pierced by urethra & rectum (and vagina in ♀).

* Pelvic floor related above to

- urinary bladder, prostate, seminal vesicle, rectum (in ♂)
- urinary bladder, vagina, broad ligament & rectum (in ♀)

MUSCLES OF PELVIS

* OBTURATOR INTERNUS :-

- **Origin**:- inner surface of obturator membrane & bones beside.
- **Insertion**:- Greater trochanter of femur.
- **Action**:- Lateral rotation of thigh.
- **Nerve supply**: N. to obturator internus (sacral plexus L₅, S_{1,2})
[NB: it emerges through lesser sciatic foramen.]

* PIRIFORMIS :-

- **Origin**:- front of sacrum (middle 3 pieces).
- **Insertion**:- Greater trochanter of femur (in upper border).
- **Action**:- Lateral rotation of thigh.
- **N/supply**:- Branches from sacral plexus (S₁, S₂).
[NB: it emerges through greater sciatic foramen].

* COCCYGEUS :-

- **Origin**:- ischial spine.
- **Insertion**:- Coccyx & Last piece of sacrum.
- **Action**:- support pelvic viscera (with levator ani).
- **N/supply**:- S₄, S₅ (sacral nerves).
[NB: the dorsal part of coccygeus is fibrosed → sacrospinous lig.]

* LEVATOR ANI :-

- **Origin**:- Pubic body, obturator fascia & ischial spine.
- **Insertion**:- divided into 3 parts:-
 - Anterior fibers (Levator prostate[♂] or sphincter vaginae[♀]) into perineal body (fibrous mass).
 - Middle fibers (Puborectalis) meet otherside fibers at anorectal junction (forming U-shaped).
 - Posterior fibers (ilio-coccygeus) into anococcygeal body and coccyx.

- **Action:-**
 - ant. fibers sphincter vagina & support prostate.
 - Middle fibers are physiological sphincter for anal canal.
 - Post. fibers with others fibers forms the pelvic floor (with coccygeus) → ↑ intra-abdominal pressure (in cough, sneez, vomiting and in Labour).
 - Levator ani & coccygeus (Pelvic floor) support viscera.
- **N/supply:-** perineal branch of S4 & pudendal nerve (pelvic side)
 - inferior rectal nerve (perineal side).

FASCIA OF PELVIS

- Pelvic fascia is a connective tissue that continuous above with abdominal wall fascia & below with perineal fascia.

① Parietal pelvic fascia:-

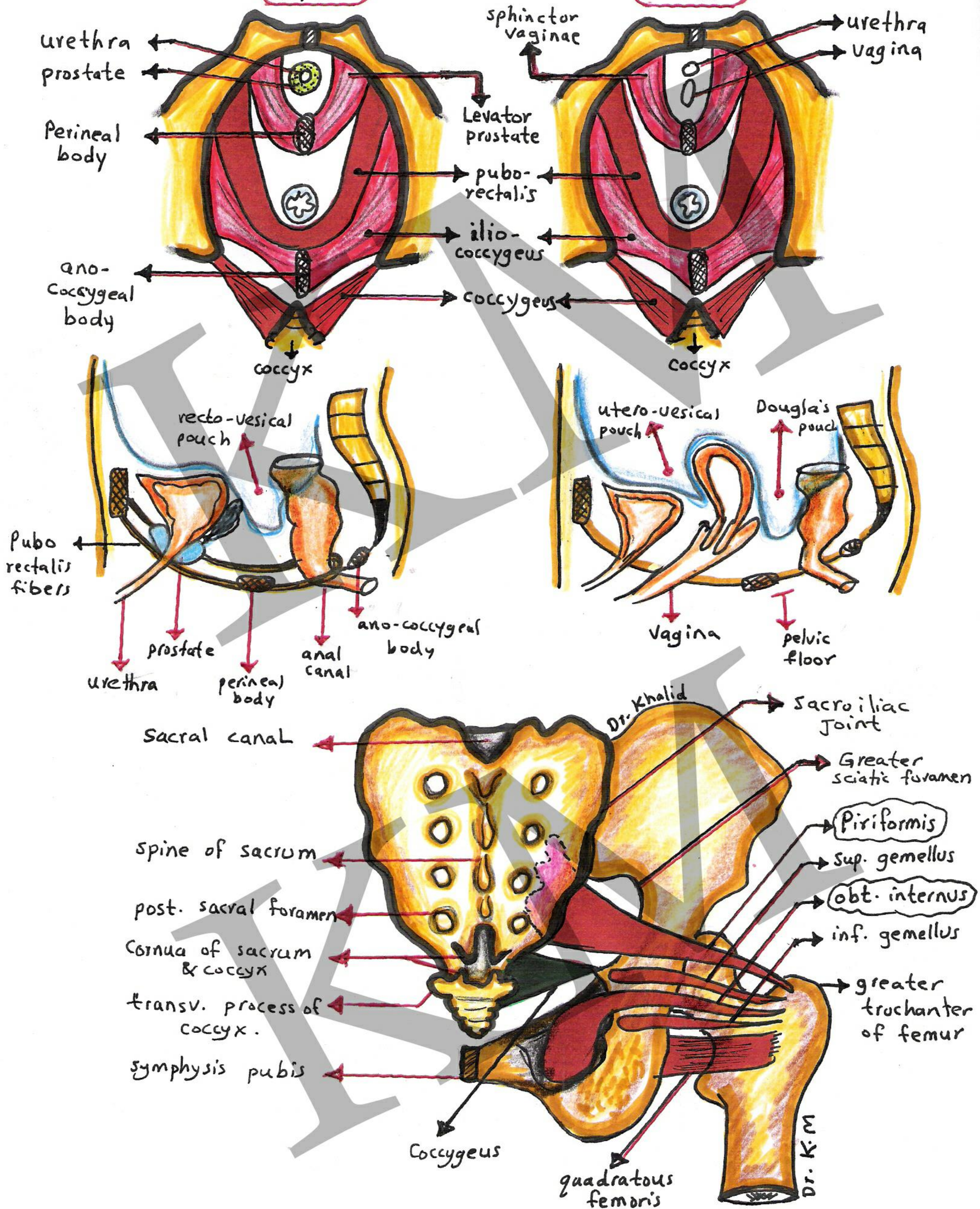
- Lines pelvic wall, named according to muscle it overlies (e.g obturator internus fascia, Levator ani & coccygeus ms)
- fascia above pelvic diaphragm (superior fascial layer) is continuous with that below it (inferior " ") through the anterior deficient of pelvic diaphragm.

② Visceral pelvic fascia:-

- Covers pelvic visceral & thickened in some places to support visceral forming fascial ligaments that named according to their attachment (e.g pubocervical and sacro cervical), so they prevent prolapse of viscera downward.
- Pelvic fascia around uterine cervix & vagin is called Parametrium.

Male

Female



* SEX DIFFERENCES IN PELVIS :-

Male Pelvis	Female Pelvis
<ul style="list-style-type: none"> - Pelvic inlet heart shaped ♥ - Pelvic outlet diamond shaped ◇ - Pelvic cavity is long & narrow - Sacrum long, narrow & curved with prominent promontary - Coccyx is more fixed - Ischial spine & tuber. are inverted - Pubic arch narrow & long - Greater sciatic notch narrow & deep. 	<ul style="list-style-type: none"> - inlet oval shaped ○ - outlet slightly rounded - cavity short, wide. - sacrum short, wide, straight & less prominent promontary. - coccyx is less fixed. - ischial spine & tub. everted - Pubic arch wide, rounded - G. sciatic notch wide, shallow

* Varieties & abnormalities of female pelvis :-


- ① Gynecoid pelvis :- (41%)
 - is typical female pelvis.
- ② Android pelvis :- (33%)
 - funnel-shaped (male) pelvis.
- ③ Anthropoid pelvis :- (24%)
 - Oval, long narrow shape.
- ④ Platypelloid pelvis :- (2%)
 - wide, with prominent promontary.

PELVIC CAVITY

* ARRANGEMENT OF MALE PELVIC VISCERA :-

- Pelvic (Sigmoid) colon → in upper part.
- Rectum & anal canal → posteriorly.
- Urinary bladder & urethra → anteriorly.
- Seminal vesicle & prostate → Middle part.
- Ureter & vas deferens → at sides.

• PELVIC PERITONEUM ♂ :-

- Rectum :- upper 1/3 → front & sides. 
 - Middle 1/3 → front.
 - Lower 1/3 → not covered.
- Urinary bladder :- superior surface & upper most of post. surface.
- Seminal vesicle :- covered at upper part.
- Prostate & anal canal :- not covered.
- Rectovesical pouch is reflection of peritoneum bet. rectum & Urinary bladder

* ARRANGEMENT OF FEMALE P. VISCERA :-

- Pelvic (sigmoid colon) → in upper part.
- Rectum & anal canal → posteriorly.
- Urinary bladder & urethra → anteriorly.
- Uterus & vagina → Middle part.
- Uterine tubes, ovary & round Lig. of uterus → at sides.

• PELVIC PERITONEUM ♀

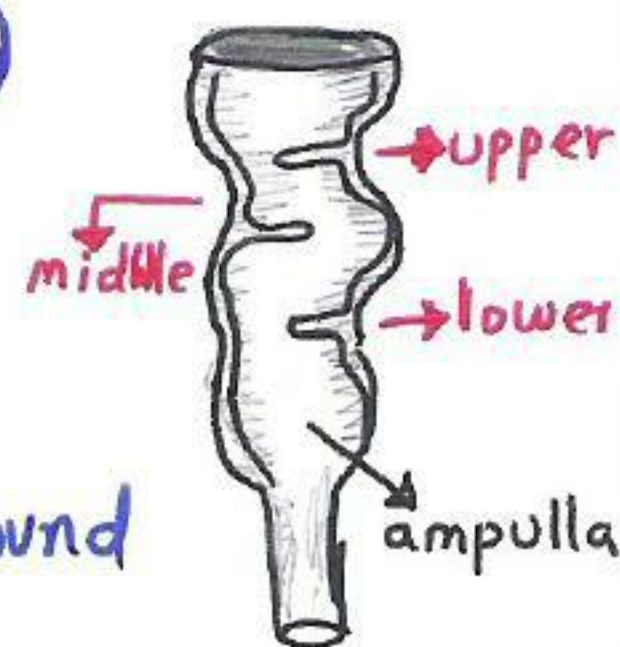
- Rectum → as male rectum.
- Vagina → upper most of post. wall.
- Urinary bladder → only superior surface.
- Ovary → has mesoovarium attached to broad Lig. of uterine tube.
- anal canal → not covered.
- Uterovesical pouch (between uterus & urinary bladder). while
- Rectouterine or rectovaginal pouch [DOUGLAS POUCH]

SIGMOID COLON:-

- sigmoid (pelvic) colon is about 10-15 inches (25-38 cm) long.
- **Beginning**:- continuation of descending colon at pelvic brim.
- **End**:- middle piece of sacrum (S3) becoming rectum.
- **Peritoneal covering**:- completely covered → have sigmoid mesocolon attached to posterior pelvic wall.
- **Relation**:-
 - anterior:- in ♂: urinary bladder.
 - inferior - in ♀: uterus & upper part of vagina.
 - Posterior:- rectum & sacrum.
- **Blood supply**:
 - sigmoidal branches of inferior mesenteric a.
 - sigmoidal veins → inf. mesenteric vein → Splenic vein → Portal vein
- **Lymph drain**:- Lymph nodes along inf. mesenteric a (inf. mes. LN)
- **Nerve supply**:- autonomic nerves from inf. hypogastric plexus

RECTUM:-

- About 5 inches (13 cm) long.
- **Beginning**:- continuation of sigmoid colon at 3rd sacral vertebra.
- **End**:- 1 inch in front & below tip of coccyx.
- It follows the curve of sacrum & coccyx and from sides has 3 curves (at Lt side → upper & lower) (at Rt side → middle curve) and the lower part of rectum dilated to form the rectal ampulla.
- Puborectalis part of levator ani forms sling around anorectal junction forming anorectal angle.
- Mucosa of rectum (with circular ms layer) forms 3 folds two at left wall & one at right wall)
- The 3 taenia coli of colon forms broad band at anterior and post. surfaces of rectum.



• Peritoneal covering of rectum

- Upper $\frac{1}{3}$ (front & side), middle $\frac{1}{3}$ (front only) and Lower $\frac{1}{3}$ (not covered).
- On each side; the peritoneum reflects to form para-rectal fossa.

• Blood supply :-

(A) * Arteries :-

1. Superior rectal \bar{a} (single) \rightarrow from inferior mesenteric \bar{a} .
2. Middle " " (paired) \rightarrow " internal iliac \bar{a} .
3. Inferior " " (") \rightarrow " internal pudendal \bar{a} .

(B) Veins :-

1. Superior rectal \bar{v} \rightarrow inferior mesenteric \bar{v} \rightarrow Portal
2. Middle " " \rightarrow int. iliac \bar{v}
3. Inferior " " \rightarrow int. pudendal \bar{v}] \rightarrow systemic circulation.

• Lymph drainage :-

- into Para rectal L. nodes which drains into:-
 - Inferior mesenteric LN (drain upper & middle parts of rectum)
 - Internal iliac LN (drain Lower part of rectum).

• Nerve supply :-

- sympathetic & parasympathetic (from inf. hypogastric plexuses)
- " it is only sensitive to stretch".

• Relation :- sup rectal artery & sacral plexus

(A) Posterior:- Sacrum, coccyx, piriformis, coccygeus, sympathetic trunk, ganglion impar, median sacral \bar{a} & glomus coccygeum.

(B) Lateral:- Pararectal fossa, Levator ani.

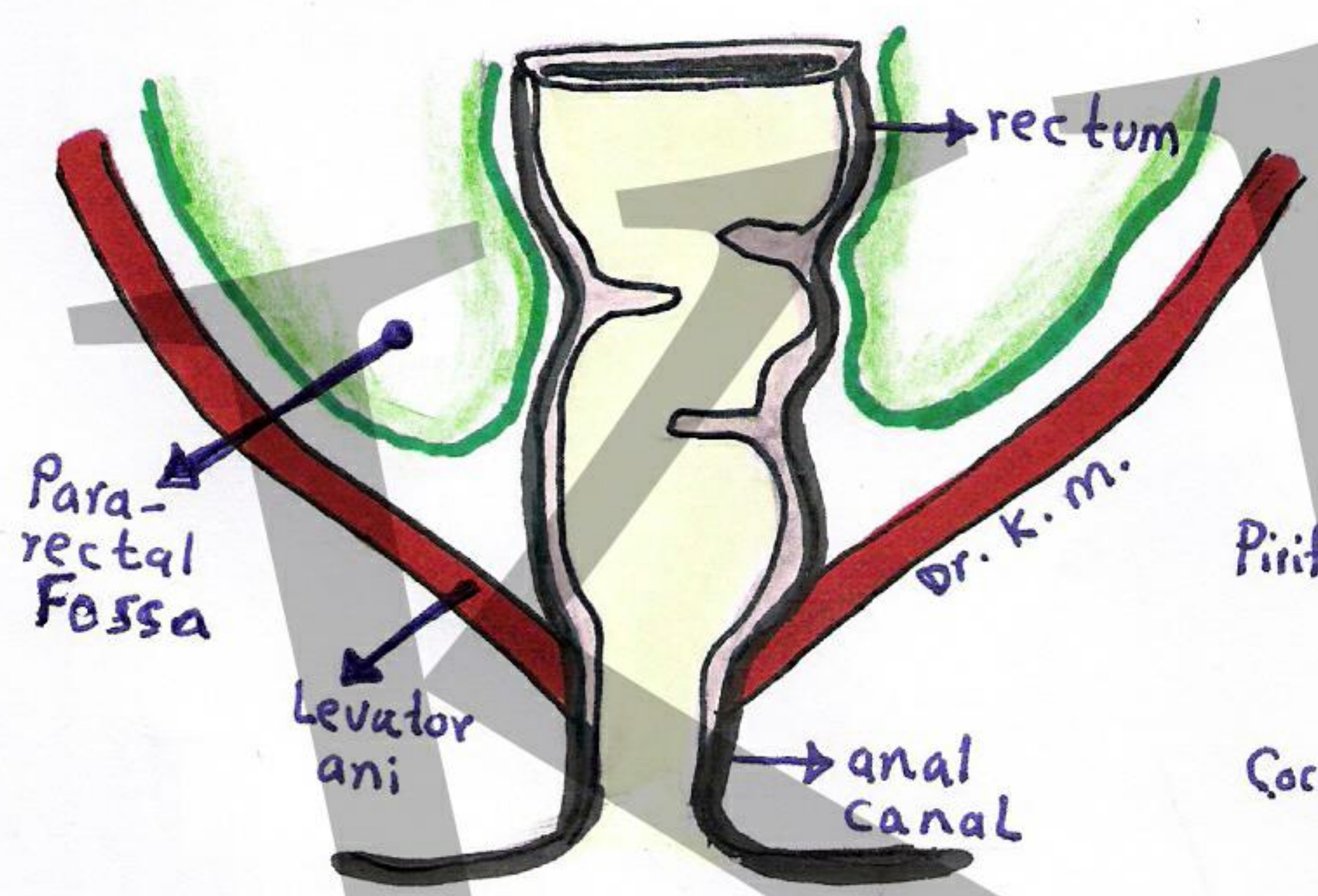
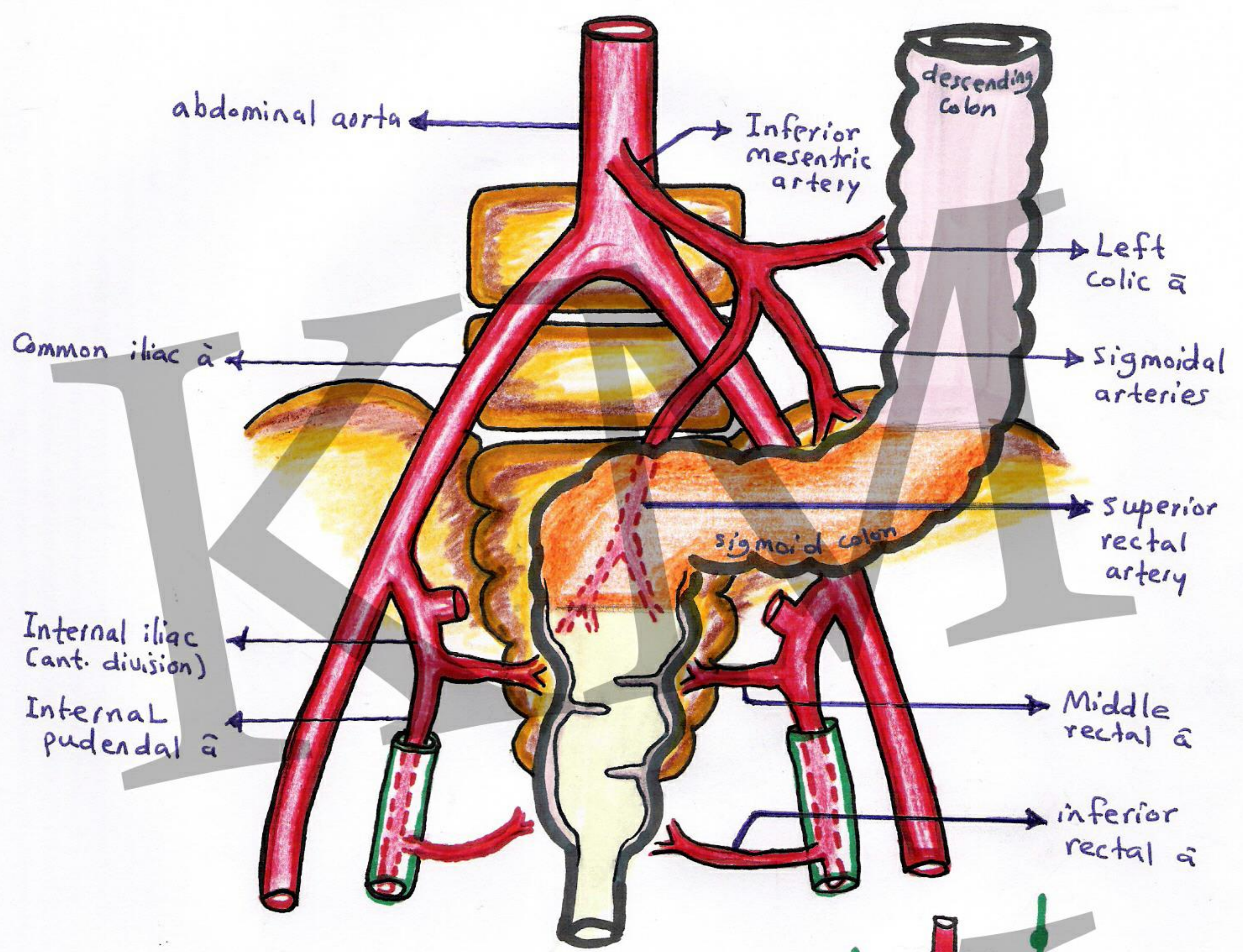
(C) Anterior:- (♀) \rightarrow Sigmoid, ileum (in upper $\frac{2}{3}$) -

\rightarrow Douglas pouch, post. surface of vagina (in lower $\frac{1}{3}$)

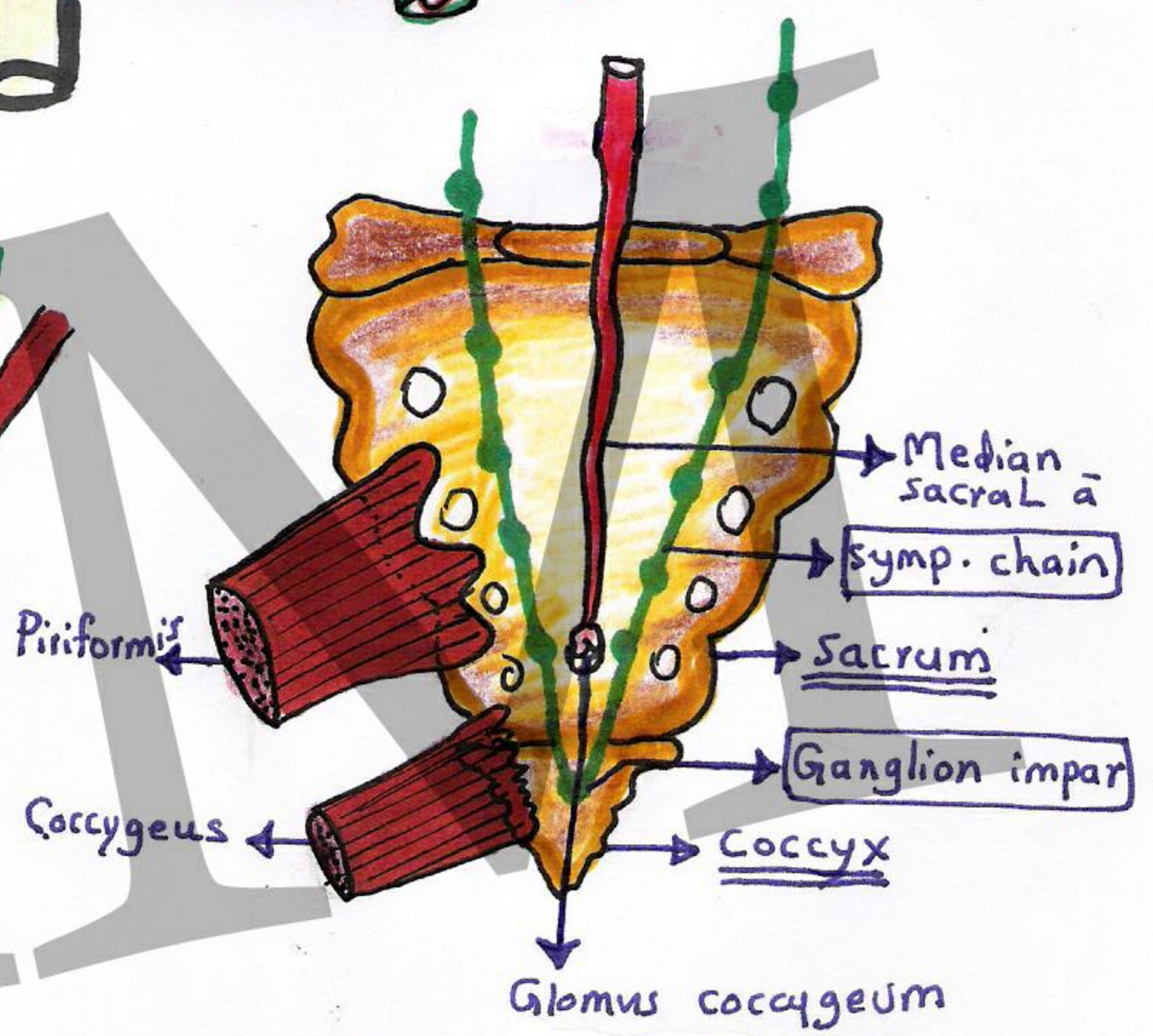
(♂) \rightarrow Sigmoid & coils of ileum (in upper $\frac{2}{3}$).

\rightarrow recto-vesical pouch, urinary bladder base, seminal vesicle & ampulla of vas. (in lower $\frac{1}{3}$).

Sigmoid & rectum



lateral relation



Post. relation

URINARY BLADDER

• Description:-

- It is situated in pelvis behind pubic bones, but as it fills rises into hypogastric region.
- When empty it is pyramidal in shape but when full is oval, with maximum capacity in adult 500 ml.
- It has apex, base, superior, 2 inferolateral surfaces & neck.

• Peritoneal covering:-

- In female only superior surface is covered.
- In male superior & upper-most of posterior surface.
- In both ♂ & ♀ the peritoneum reflects at sides to form para-vesical fossa.
- Posteriorly it reflects to form rectovesical pouch (in ♂) and uterovesical pouch (in ♀).

• Trigone of bladder:-

- Triangular area of bladder mucosa at bladder base between 2 ureteric orifices (above) & the internal urethral orifice (below)
- Because it is composed of elastic tissue, so it is smooth (also because it is firmly attached to muscular coat) while the rest of bladder is folded when bladder is empty forming rugae

• Blood supply:-

- Arteries from ① superior vesical a (from umbilical).
② inferior vesical a (from int. iliac):- (in ♀ vaginal)
- Veins from bladder forms "Vesical venous plexus"
(communicate with prostatic plexus) → into internal iliac vein.

• Lymph drainage of bladder

= Into internal & external iliac Lymph nodes.

• Nerve supply :-

- from inferior hypogastric plexuses.
 - Sympathetic → from T₁₁. T₁₂. L₁. L₂.
 - parasympathetic → from S₂. 3. 4.

• Relation :-

- * Superior:- sigmoid colon & coils of ileum (+uterus in ♀).
- * Inferolateral:- obturator internus ms., Levator ani & pubic bones.
- * Posterior:- (♀) → cervix of uterus & ant. wall of vagina
 (base)
 (♂) → rectum, seminal vesicle & ampulla of vas.
- apex → related to symphysis pubis [and attached to umbilicus by urachus "remains of allantois"].
- Supero-lateral angle → joined by ureters.
- Inferior angle (neck) → gives rise to urethra and in male rests on prostate.

VAS DEFERENS

- The vas (ductus) deferens is a thick tube (45 cm = 18 inch) that starts at tail of epididymis and ends (after forming ampulla of vas) by uniting with the seminal vesicle to form ejaculatory duct.

• Course & relation:-

- Passes through inguinal canal, leaves the deep inguinal ring & hooks around inferior epigastric vessels and crosses the following structures: in order :- ① ext. iliac vessels, ② umbilical a, ③ obturator nerve & vessels, ④ inferior vesical vessels and finally crosses the ureter in region of ischial spine.

• function:-

- conducts mature sperms from epididymis to ejaculatory duct and urethra.

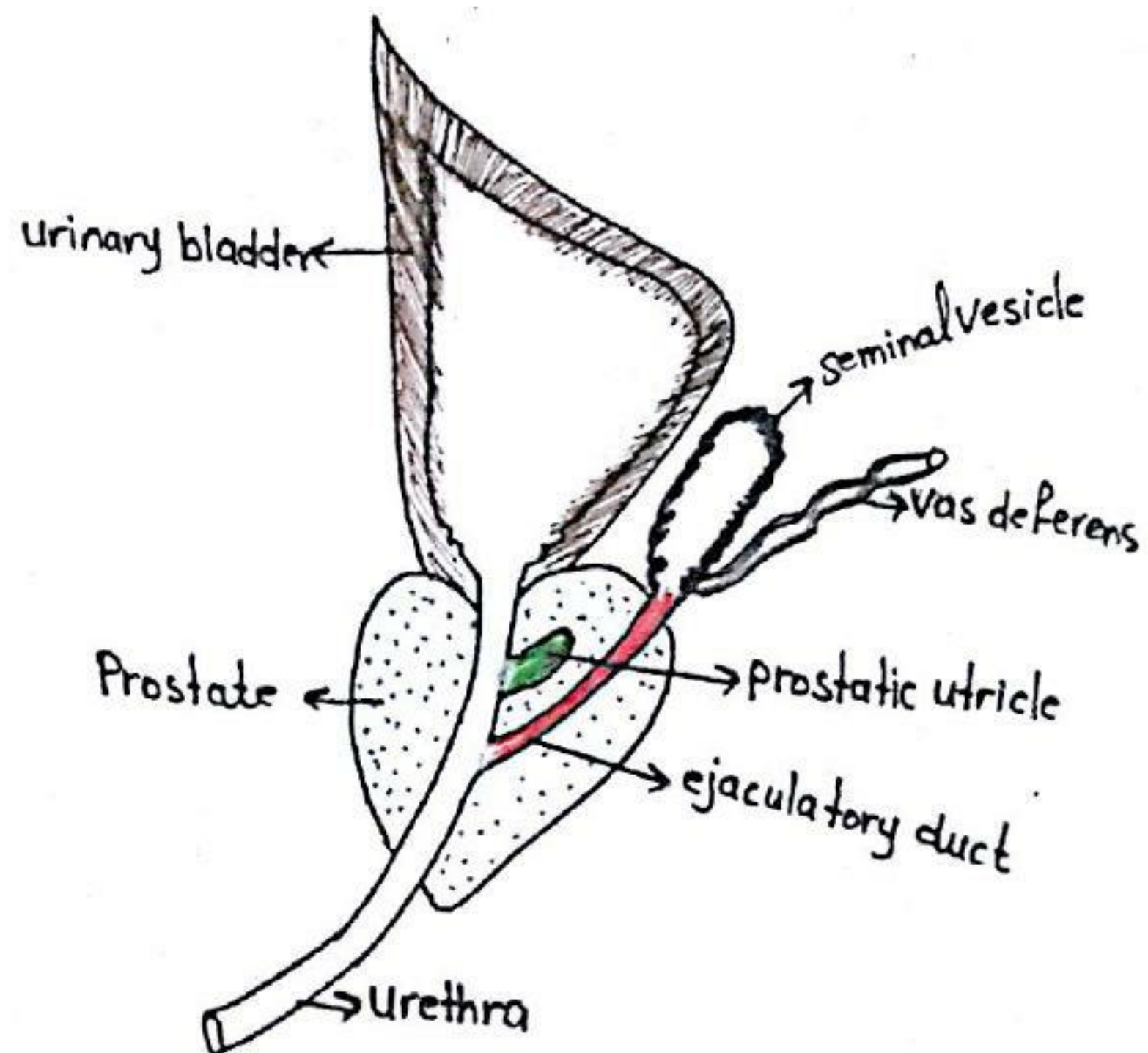
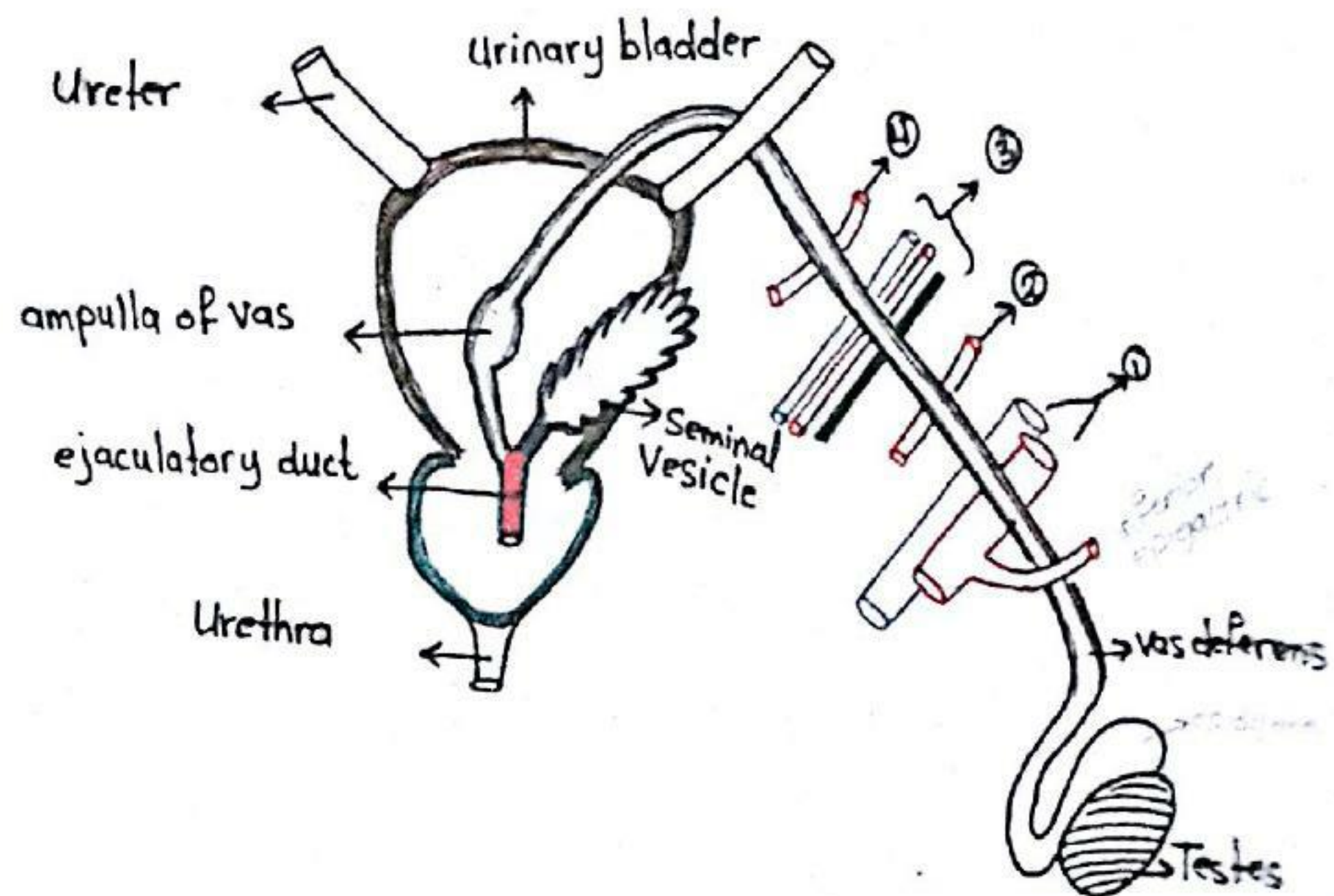
• Blood supply:-

- The vas is supplied by artery to the vas from inferior vesical artery.

SEMINAL VESICLE

- Lobulated sac (5 cm long) that produce secretions added to seminal fluid (to nourish sperms)
- Connected to vas deferens to form ejaculatory duct that pierces prostate to open into the prostatic urethra.

Relation of vas deferens.



FEMALE URETHRA

- It is 4 cm long, wider, shorter & more dilatable than male urethra.
- Starts at bladder neck & descends downward and forward passing through deep and superficial perineal pouches and opens into vestibule (in front of vaginal orifice).

MALE URETHRA

- It is 20 cm (8 inches) long, divided into

① Prostatic urethra:- (1 inch):-

- Widest & most dilatable part.
- It's mucosa posteriorly forms crest (urethral crest) and on sides of crest there is urethral sinus, & below the crest is seminal colliculus into which opens the ejaculatory ducts and prostatic utricle (blind pouch that projects up & backward).
- The ducts of prostate open directly at prostatic sinus.

② Membranous urethra:- ($\frac{1}{2}$ inch):-

- Shortest, narrowest & least dilatable part.
- It passes through deep perineal pouch.
- It is surrounded by sphincter urethrae.

③ Spongy (Penile) urethra:- ($6\frac{1}{2}$ inches):-

- Longest part.
- Enters bulb of penis & having intrabulbar fossa.
- It's terminal part forms fossa navicularis (terminalis) and narrows to form external urethral orifice which is the narrowest point of all urethra.

N.B :- Urethra has 2 sphincters :-

① Internal sphincter :-

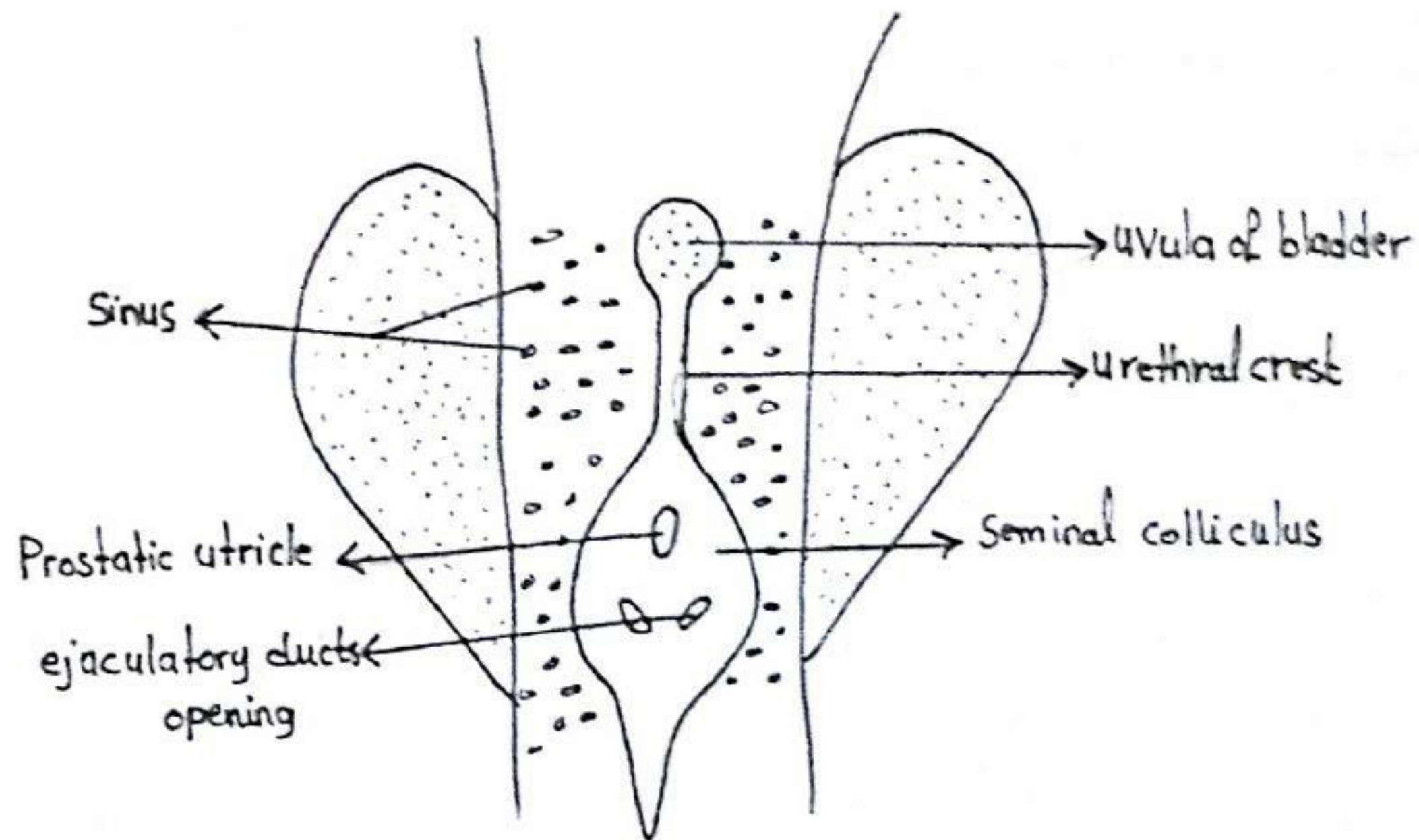
- At its beginning (called internal urethral sphincter), it is involuntary (supplied by autonomic N.).

② External sphincter :-

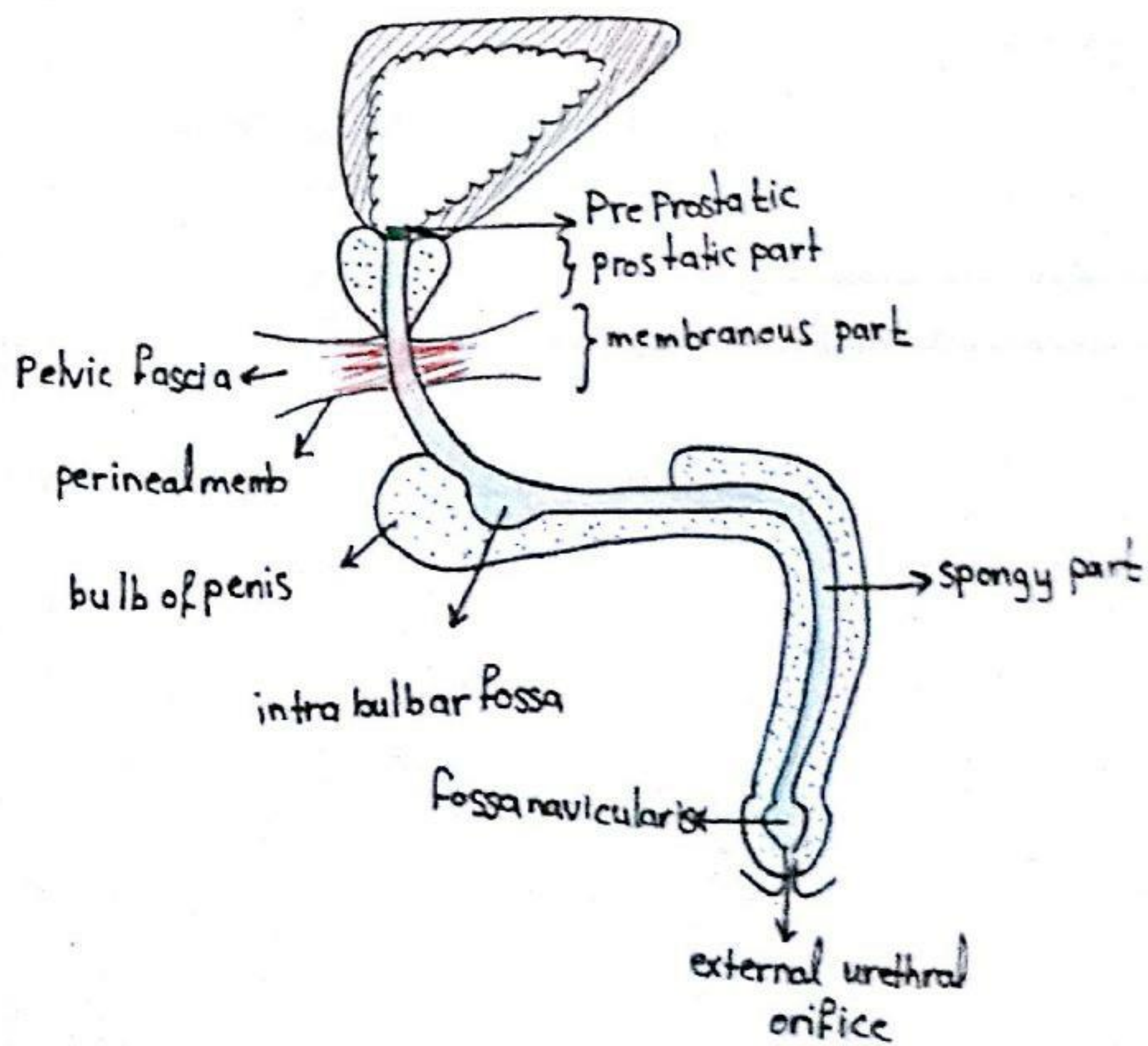
- At membranous urethra (called external urethral sphincter), it is voluntary (supplied by perineal br. of pudendal N.).

*Clinical note:-

- Membranous part is the most commonly injured part, the urine escape into deep perineal pouch → to superficial perineal pouch → to anterior abdominal wall (deep to membranous layer of deep fascia). below umbilicus.
- If injured spongy part, urine → to superf. per. pouch → to ant. abd. wall.



[Parts of urethra]



PROSTATE

* Description:-

- Prostate gland is a firm fibromuscular gland that surrounds prostatic urethra, about 3 cm (1 1/4 inch) long.
- Formed of multiple glands embedded in C.T and smooth ms and its glands ducts open into the prostatic urethra.
- Surrounded by ① fibrous capsule: around prostate.
② fibrous sheath: around capsule (it is part of pelvic visceral layer).
- Situated between neck of bladder (above) and urogenital diaphragm (below).
- It has a conical shape with apex (below), base (above), anterior, posterior & 2 inferolateral surfaces.
- It has 5 lobes (incompletely separated)
 - Median (middle) lobe:- between urethra & ejaculatory ducts.
- rich in glands.
 - Posterior lobe:- behind urethra, contains glands.
 - Anterior lobe:- in front " , contain no glands
 - Rt & Lt lobes:- at sides of " , contain many glands.
- Function of prostate is to produce thin, milky alkaline fluid (to neutralize vaginal acidity) rich in citric acid and acid phosphatase added to seminal fluid at time of ejaculation by smooth ms. contraction → squeezed into prostatic urethra.

* Blood supply:-

- **Arterial:-** ① inferior vesical a (mainly) ② Middle rectal a.
- **Venous:-** Prostatic venous plexus (bet. fibrous capsule & sheath — that receives ^{deep} dorsal vein of penis & vesical veins) → into internal iliac vein.

*** Lymph drainage :-**

- into internal iliac L. nodes.

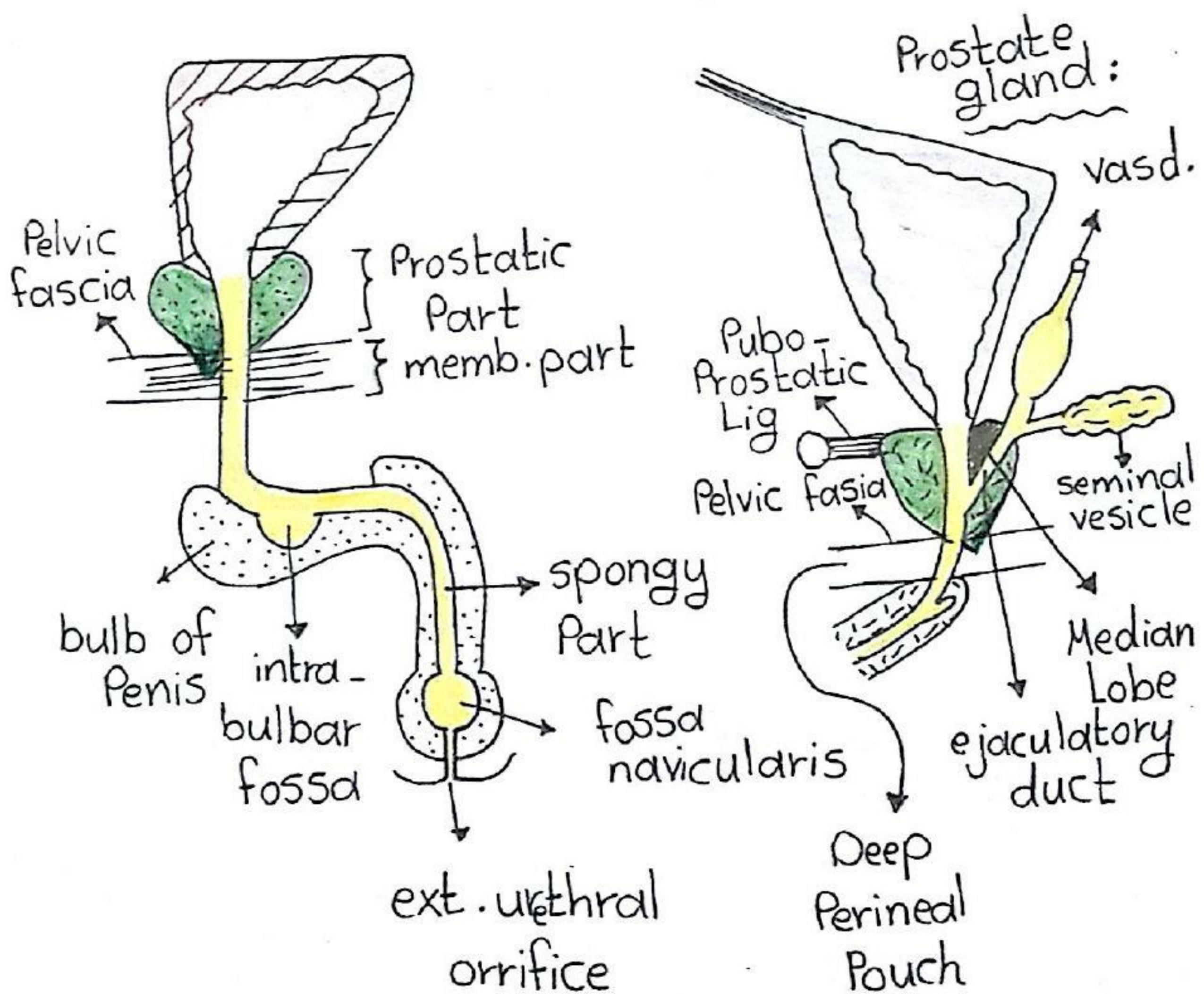
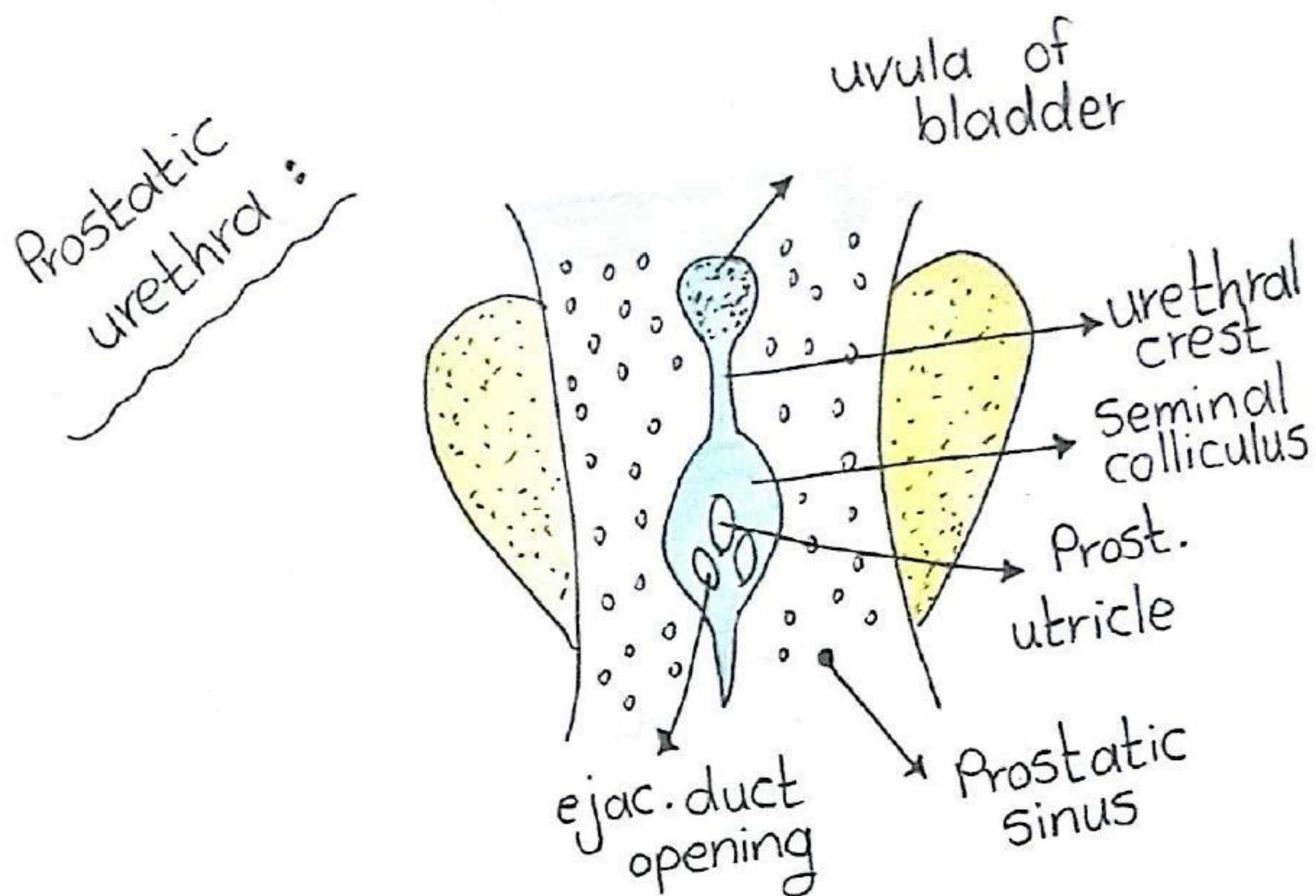
*** Nerve supply :-**

- by inferior hypogastric plexuses :- , sympathetic nerves stimulate smooth ms. of prostate during ejaculation. (NB erection by parasymp. while ejaculation sympathetic).

*** Relation of prostate :-**

- Base (superior) :- related to bladder neck.
- Apex (inferior) :- " " pelvic fascia (urogenital diaphragm)
(NB: urethra leaves prostate just above apex on anterior surface).
- Anterior surface :- symphysis pubis
 - retropubic space (space of Retzius)
 - Puboprostatic Ligaments.
- Posterior surface :- rectal ampulla.
 - recto-vesical septum (fascia of Denonvillier).
- Inferolat. surface :- Levator ani muscles.

NB:- Recto-vesical septum (fascia of Denonvillier) is formed in fetal life by fusion of walls of lower ends of rectovesical pouch "which was extended down to perineal body".



UTERUS

*Description:-

- Uterus is pear-shaped. \bar{e} Δ cavity in coronal section (and cleft like in sagittal)
- In young nulliparous adult measures 3 inches (8 cm) long, 2 inches (5 cm) wide & 1 inch (2.5 cm) thick
- It lies between bladder & rectum (in pelvis), but in pregnancy projects up into abdomen.
- Normal position of uterus is ANTE.FLEXED, ANTEVERTER
 - Anteflexion:- between long axis of uterus & cervix (170°).
 - Anteversion:- " " " " cervix & vagina (90°).
 - In some women it may be retroflexed or retroverted.
- Parts of uterus are:-
 - ① Fundus:-
 - Free rounded end above entrance of uterine tubes.
 - ② Body:-
 - the Part below uterine tube & continue below with cervix (as it narrow below to form isthmus).
 - ③ Cervix:-
 - Pierces anterior wall of vagina & divided into:
 - Supravaginal part (has peritoneal cover at it's back).
 - vaginal part (surrounded by vaginal fornices).
 - Cervix cavity (cervical canal) is spindle-shaped which is has an opening with cavity of body (internal os) and with vagina (external os).

* Peritoneal covering :-

- Fundus is covered completely.
- Body is covered anteriorly & posteriorly and forming uterovesical pouch with bladder.
- Cervix only posterior to supravaginal part.
- Vagina only upper most of post. surface & forms Douglas Pouch with rectum posteriorly.

- Between lateral border of uterus & side wall of pelvis a fold of peritoneum called BROAD LIGAMENT.

• Parts of Broad Ligament:-

- ① Meso-metrium:- most of broad. (rest).
- ② Meso-salpinx:- between ovary & uterine tube.
- ③ Meso-ovarium:- by which ovary is attached to post. aspect.
- ④ Suspensory lig. of ovary:- Lateral to mesoovarium.

• Contents of Broad Ligament:

- ① uterine tube: in free upper border.
- ② uterine vessels.
- ③ ovarian vessels.
- ④ round Lig. of uterus.
- ⑤ round lig. of ovary.
- ⑥ fat, Lymph vessels & nerves.
- ⑦ Epophoron:- vestigial remnant of mesonephros [above mesoovarium]
- ⑧ Par ophoron:- " " " " [lat. to uterus]

* Blood supply of uterus:-

- arterial: by uterine artery (br. of internal iliac \bar{a}).
- venous: to " " vein (Drain into " " \bar{v}).

[NB] Uterine tube supplied by uterine \bar{a} & ovarian \bar{a} (br. of aorta)

* Lymph drainage:-

- fundus:- into Paraortic LN :: following ovarian artery.
- Body & cervix:- into internal and external iliac LN.
- few lymphatics from lateral angle of uterus follow the round lig. of uterus drain into superficial inguinal LN

* Nerve supply:-

- by autonomic nerves from inferior hypogastric plexus.

NB: UTERINE TUBE:

- is 4 inches (10 cm) Long, Lies in free upper part of broad Lig
- Parts are:- ① infundibulum ③ isthmus (narrowest)
- ② ampulla (widest) ④ intramural part.

*Relation of uterus:-

- Anterior:- superior surface of bladder & utero vesical pouch.
- Posterior:- sigmoid, rectum, coils of ileum & recto uterine pouch.
- Lateral:- Body related laterally to uterine a & broad lig.
 - Supravaginal cervix to ureter.

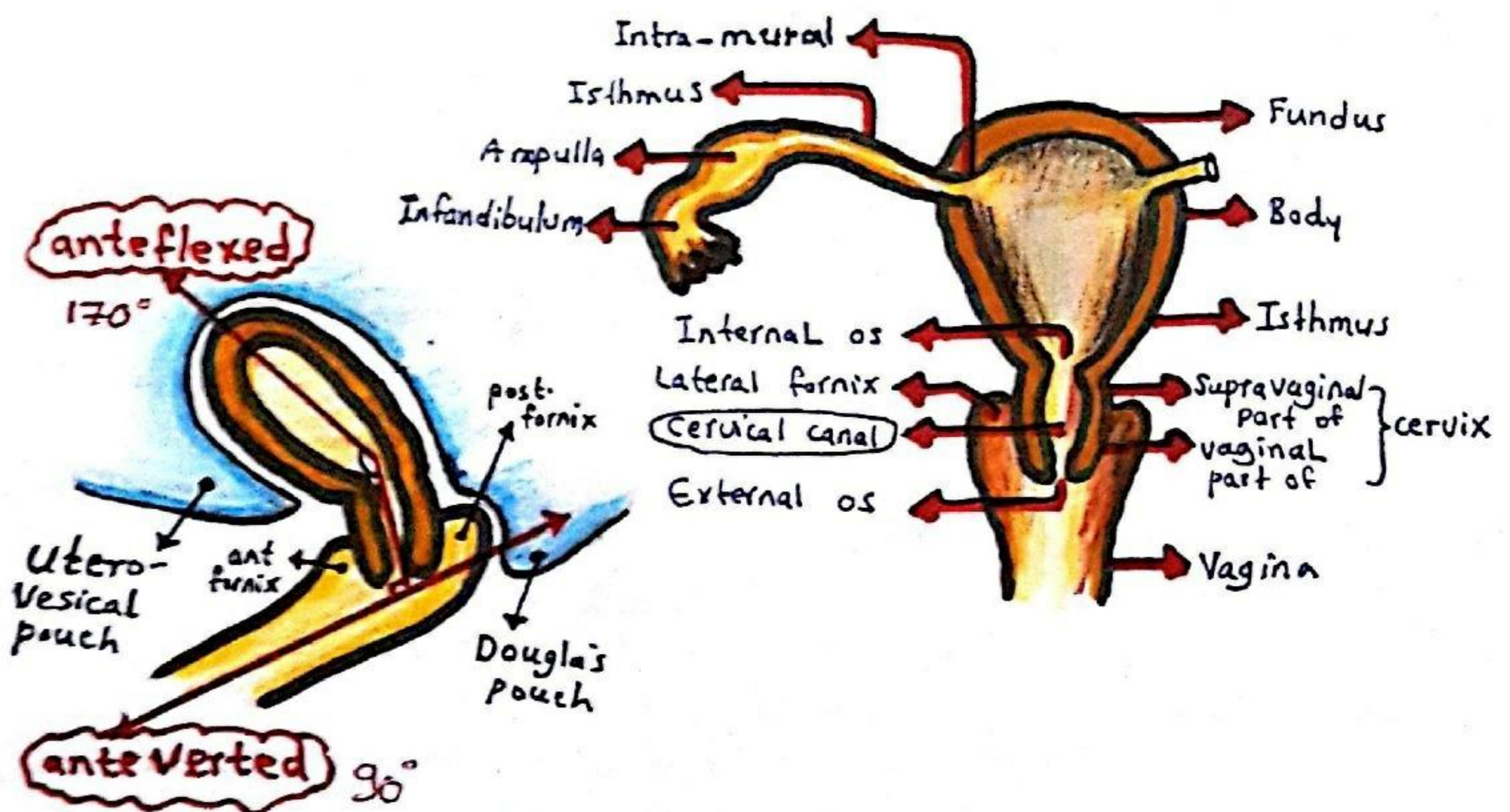
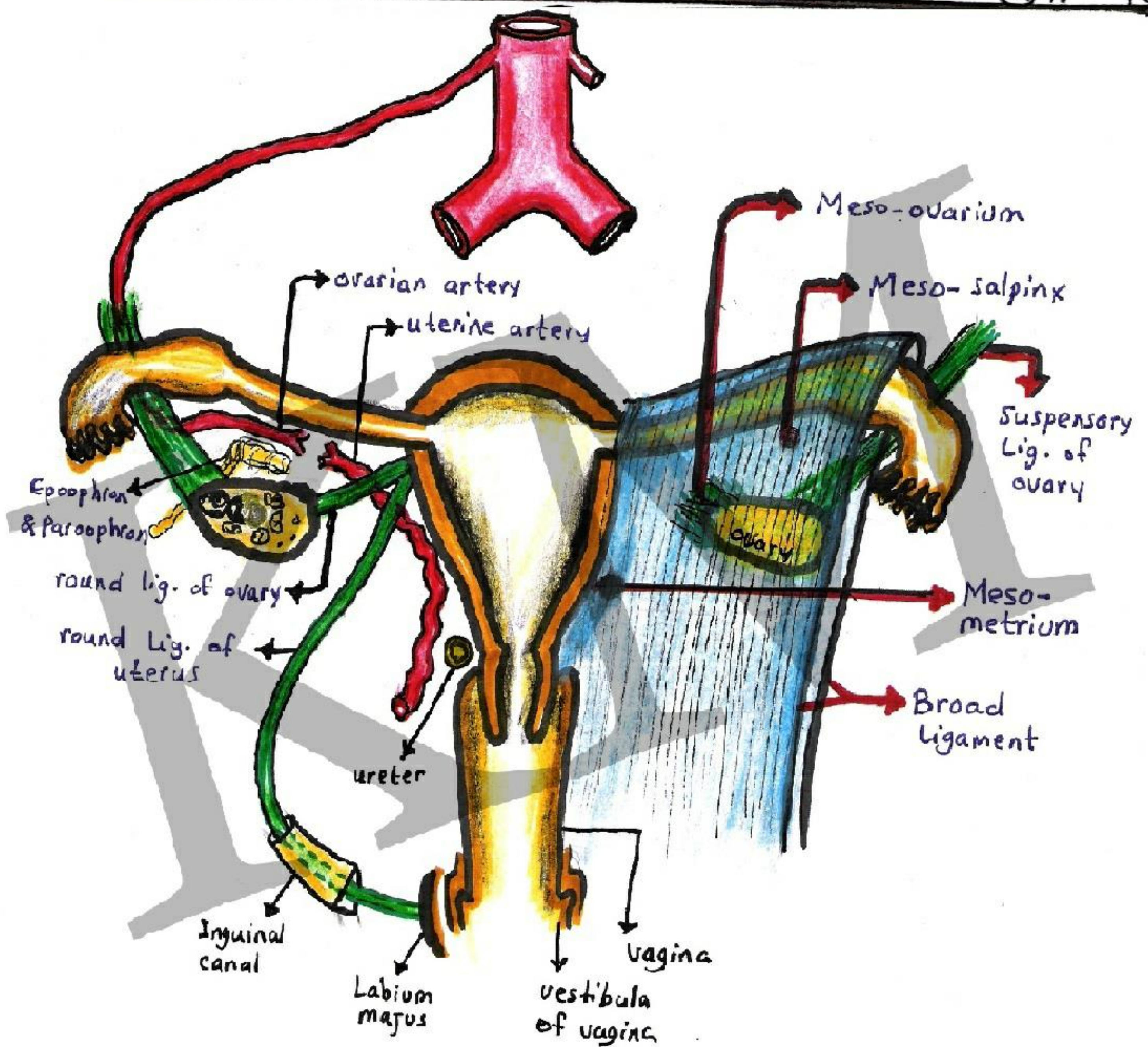
* Support of uterus & Ligaments:-

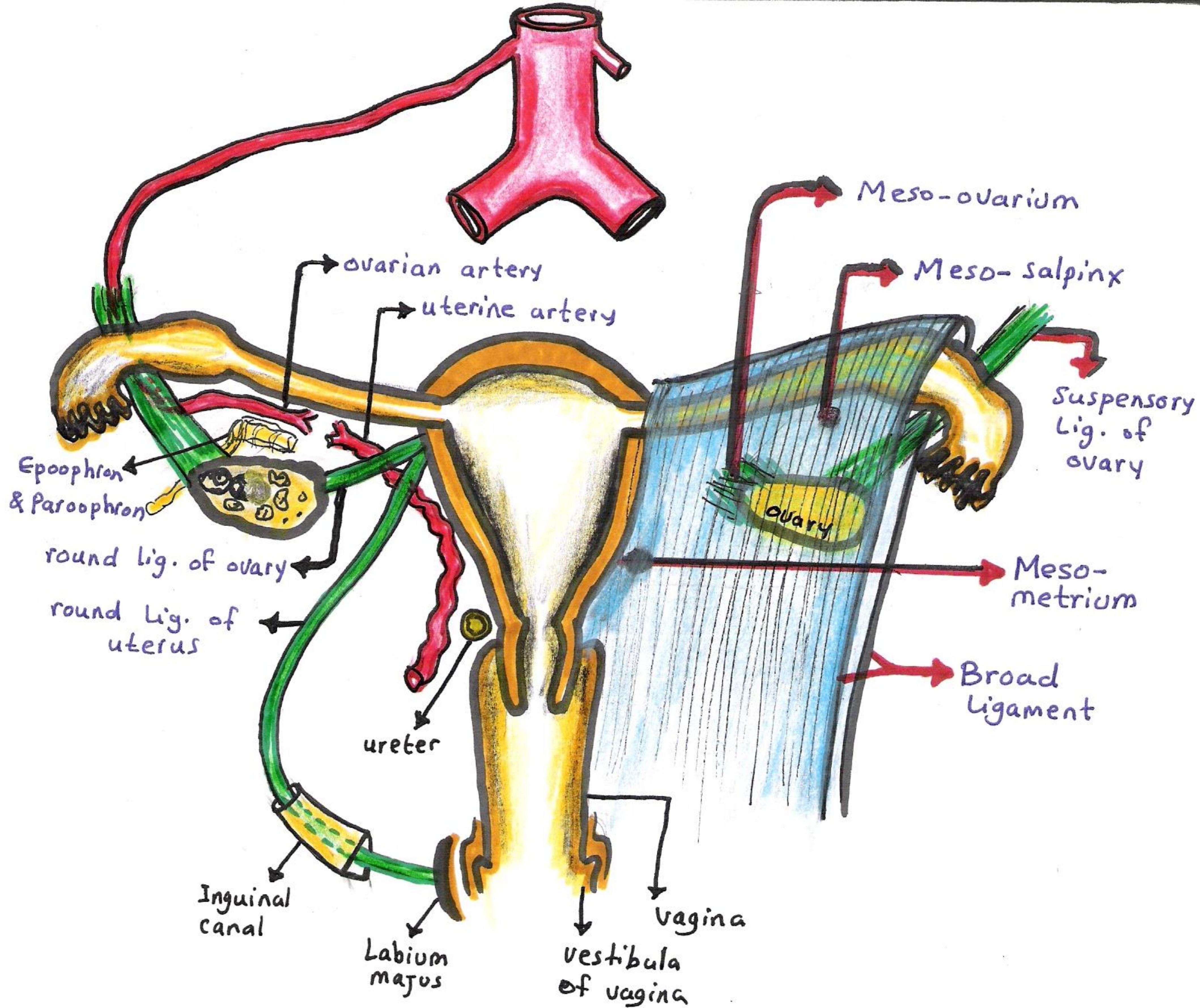
① Peritoneal ligaments:-

- Utero sacral, utero vesical & rectovaginal.

② Non-peritoneal Lig:-

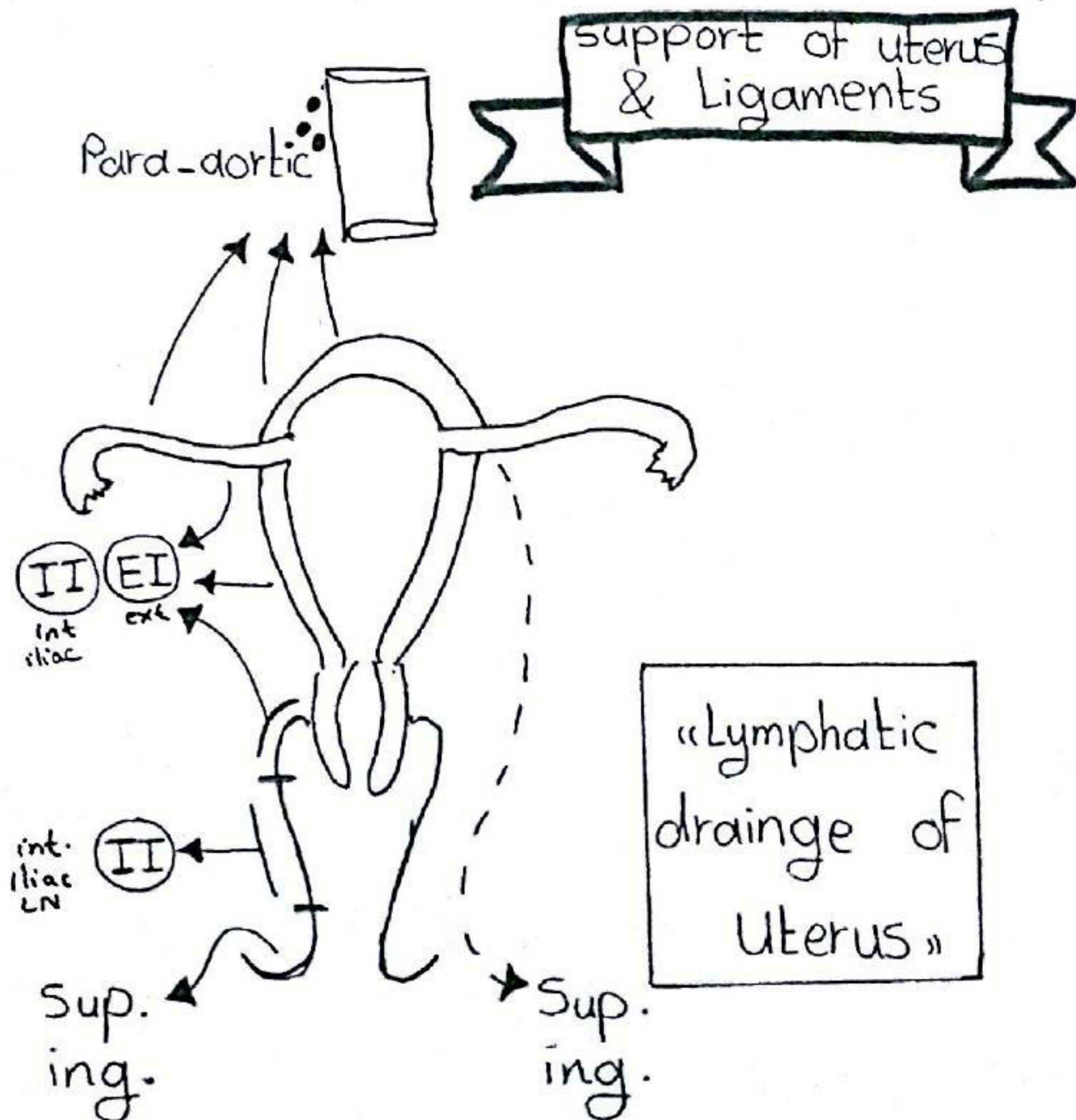
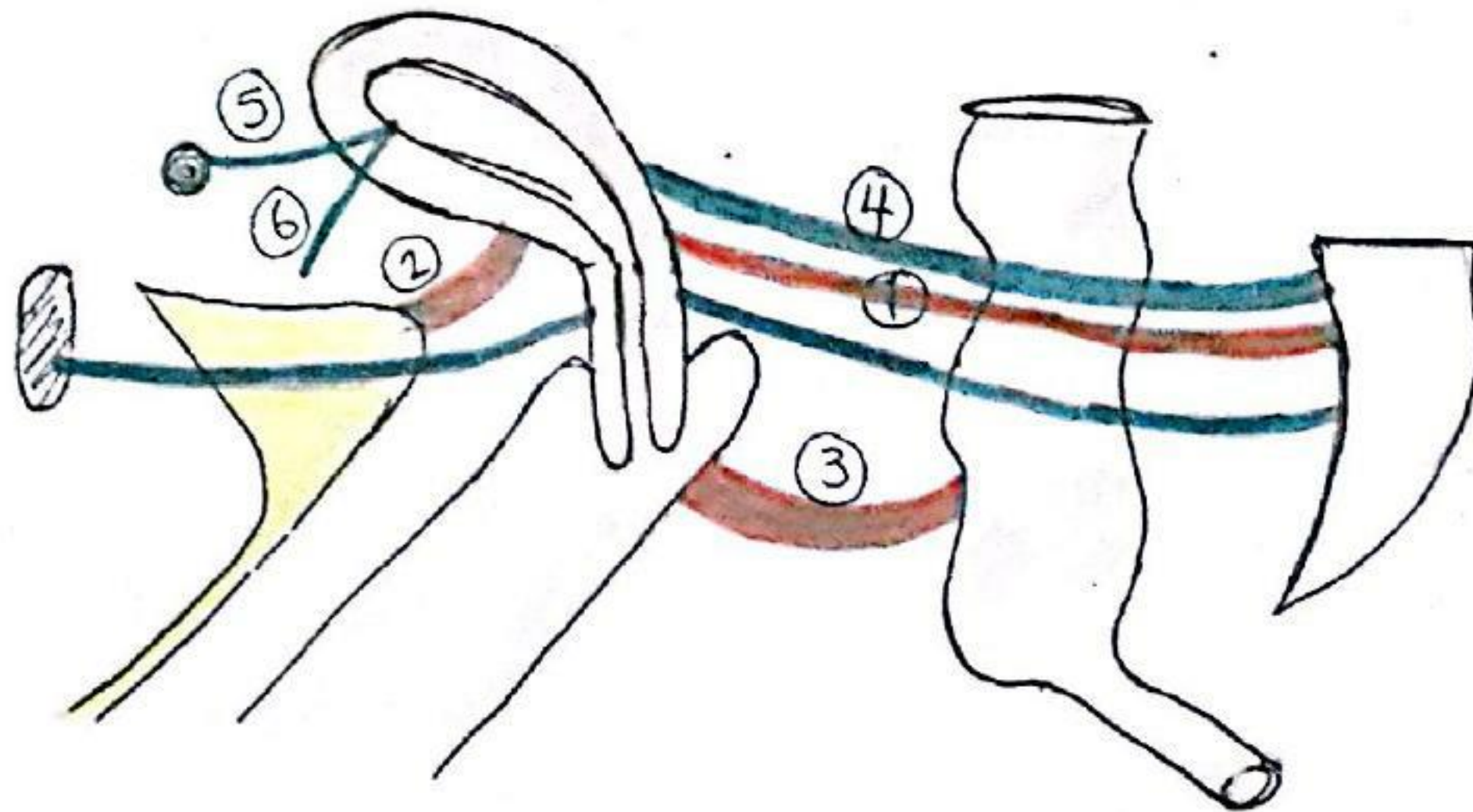
- Round lig. of uterus & ovary (attach below entrance of uterine tube to body of uterus)
- Utero-sacral & transverse cervical ligament.





Peritoneal Lig: ① uterosacral ② uterovesical
③ Rectovaginal

Non peritoneal Lig :- ④ uterosacral
⑤ ovarian Lig ⑥ round Lig of uterus



VAGINA

* Description :-

- Muscular tube between vulva & uterus.
- Anterior wall (7.5 cm) is shorter than posterior wall (9 cm).
- It's lower $\frac{1}{2}$ lies in perineum.
- In it's lower part has a thin mucosal fold (hymen).
- Vagina forms around vaginal part of cervix 4 fornices.
 - ① Anterior fornix :- shallow.
 - ② Posterior fornix :- deep.
 - ③ Lateral fornices (two) :- related to ureter & uterine artery.

* Relation :-

- Anterior :- bladder & urethra
- Posterior :- (upper $\frac{1}{4}$) \rightarrow Douglas pouch. (upper $\frac{1}{4}$ covered post. by peritoneum)
(Middle $\frac{2}{4}$) \rightarrow ampulla of rectum.
(Lower $\frac{1}{4}$) \rightarrow Perineal body & anal canal.
- Lateral :- Levator ani & pelvic fascia [Lat. fornix \rightarrow ureter, uterine a].

* Blood supply :-

- Arterial by vaginal a (+ uterine a) & veins into int. iliac vein

* Lymph drain :-

- (Upper $\frac{1}{4}$) into ext & int. iliac LN, (middle $\frac{2}{4}$) into int. iliac LN
(Lower $\frac{1}{4}$) into superficial inguinal LN.

* Nerve supply :-

by inferior hypogastric plexuses of nerves.

N.B. :-

- vagina is supported by :-

- | | |
|-----------------------|-------------------------|
| ① Pubo-cervical Lig. | ③ transv. cervical Lig. |
| ② Sacro-cervical Lig. | ④ Perineal body. |
| ⑤ Levator ani ms. | ⑥ urogenital diaphragm. |

OVARY

* Description :-

- The two ovaries are situated on each side of uterus attaching to back of broad ligament by mesoovarium.
- It is almond-shaped measuring $1\frac{1}{2} \times \frac{3}{4}$ inches (4 X 2 cm).
- Each ovary lies in a depression in lateral wall of pelvis called OVARIAN FOSSA.
- Boundaries of ovarian fossa :-
 - anterior :- umbilical artery
 - Posterior :- internal iliac a & ureter.
 - above :- external iliac a.
 - obturator nerve crosses floor of fossa.

* Blood supply :-

- Arterial :- by ovarian (gonadal) a : br. of abdominal aorta.
- Venous :- by ovarian vein which drain into I.V.C (in Rt side) or left renal vein (in Lt side).

* Lymph drainage :-

- following ovarian a into Para-aortic LN.

* Nerve supply :-

- from aortic plexus following ovarian a.

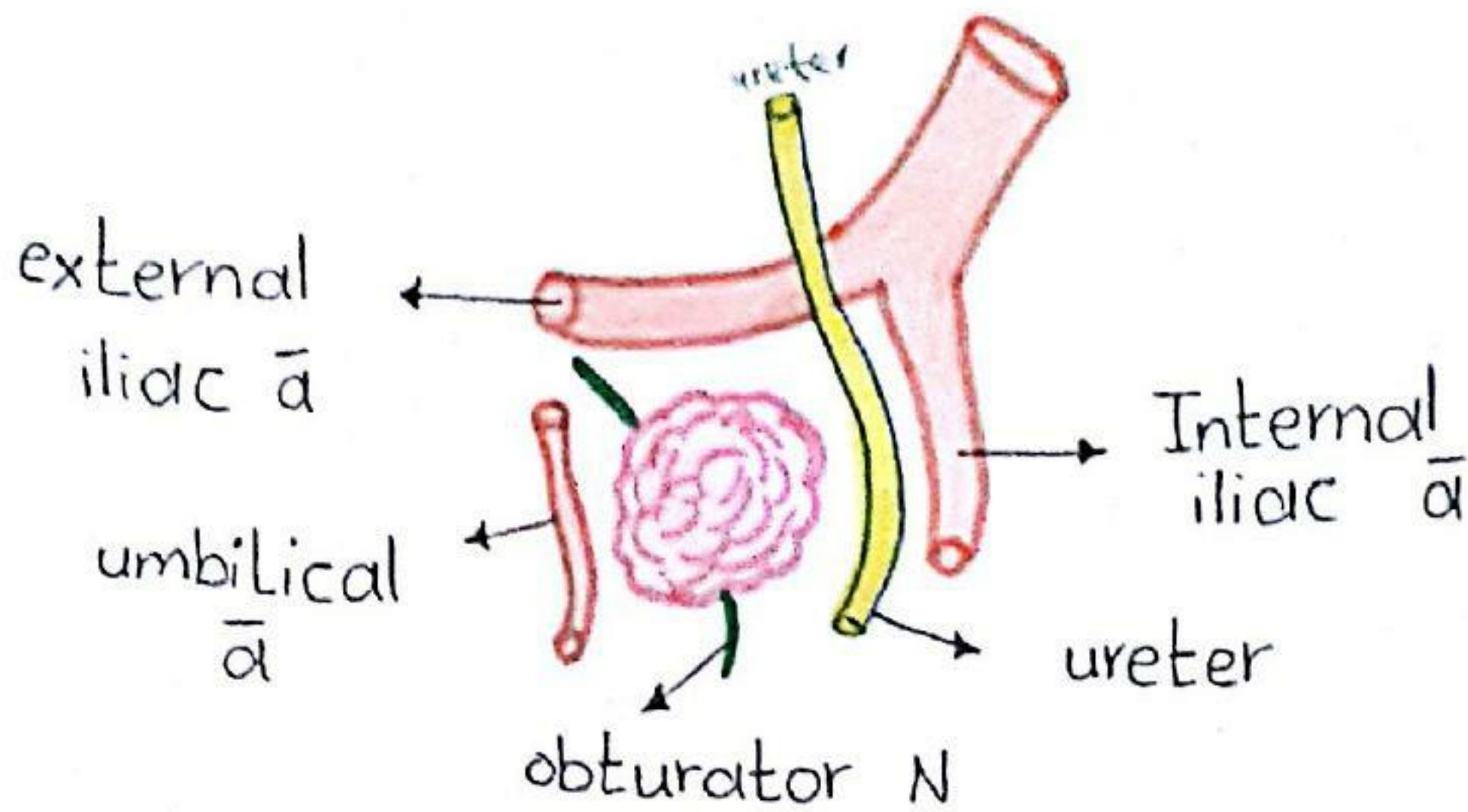
* Relation :-

- upper end (attach to uterine tube by suspensory lig. of ovary.)
- lower end (" " angle of uterus by round " " ").
- Medial surface :- covered by fimbriated end of uterine tube
- Lateral " :- related to ovarian fossa.
- anterior border :- has mesoovarium attaching to broad lig.
- posterior " :- free & related to ureter.

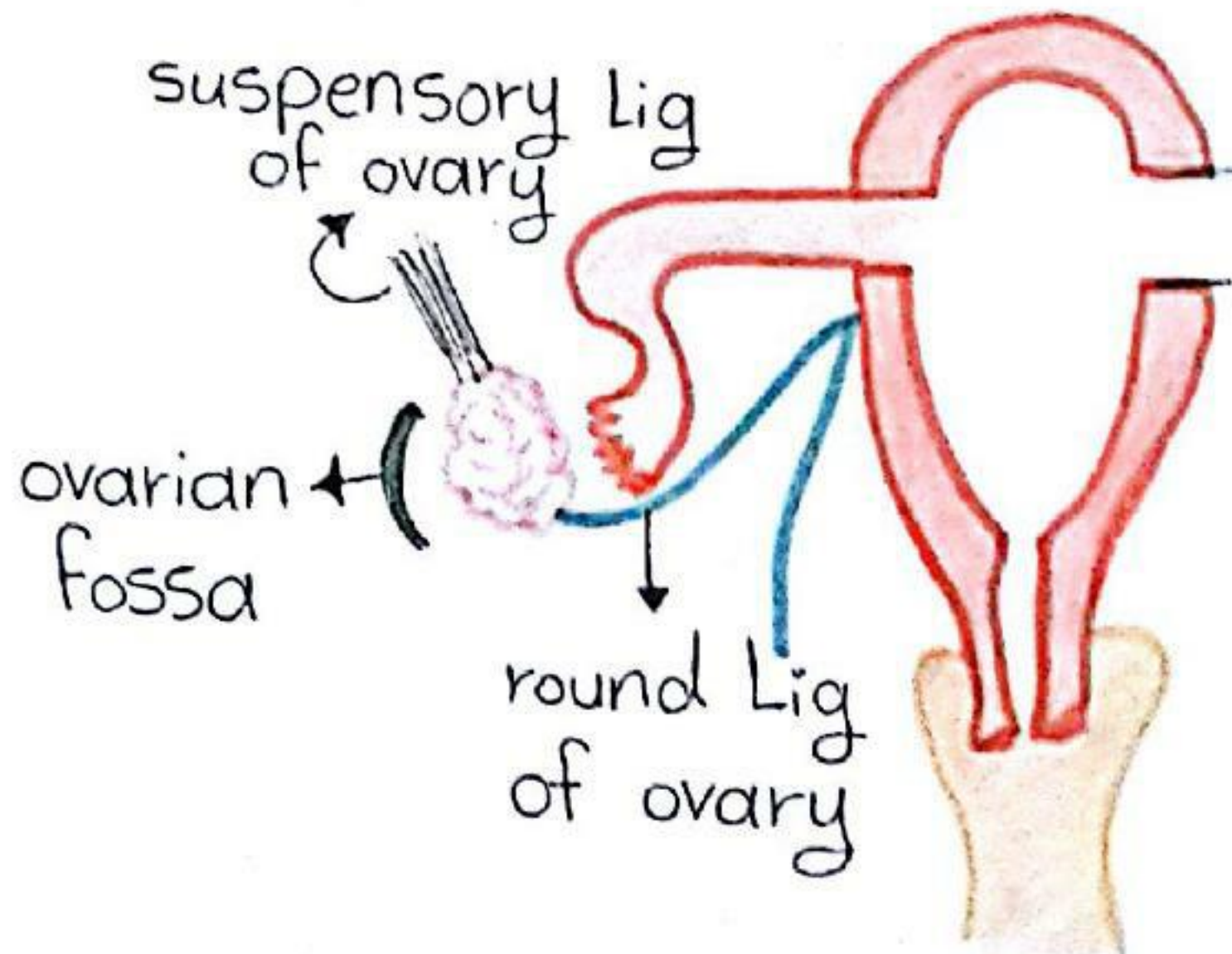
Notes about ovary:-

- Ovarian vessels, nerves & lymphatics reach ovary by passing through suspensory lig. of ovary and enter hilum of ovary via mesovarium.
- Round lig. of ovary is the remains of upper part of gubernaculum [round lig. of uterus remains of lower part].
- Ovary is smooth before puberty but after puberty becomes progressively scarred until after menopause becomes shrunken & pitted with scars.
- function of ovary is:-
 - 1- female germ cells:- (ova.).
 - 2- female sex hormones:- (estrogen & progesterone).

OVARY



Ovarian fossa



Relation of ovary

ARTERIES OF PELVIS

① Median sacral artery:

- = Branch of back of bifurcation of abdominal aorta.
- = Small artery that descends over front of sacrum & coccyx.
- = End at Glomus coccygeum (fibrocellular mass at coccyx).
- = Gives the 5th lumbar arteries.

② Superior rectal artery:

- = Direct continuation of inferior mesenteric a (at crossing of left common iliac a).
- = Divides into Rt & Lt branches behind rectum, then pierces muscular layer.
- = Supplies mucous membranes of the rectum & anal canal.

③ Ovarian artery: (only in ♀):

- = Branch of abdominal aorta.
- = It crosses the external iliac a at pelvic inlet.
- = Enters the suspensory lig. of ovary, then broad lig. and enters the ovary through mesovarium.
- = [NB] In male pelvis no testicular a bec. it enters the inguinal canal.

④ Internal iliac artery:

- = One of 2 terminal branches of common iliac a at pelvic inlet (in front of sacroiliac joint).
- = It supplies pelvic wall, viscera, perineum & buttocks.
- = It is divided into anterior and posterior divisions (at upper margin of greater sciatic foramen).

* Branches of internal iliac a :-

- It gives anterior & posterior divisions:-

(A) POSTERIOR DIVISION :- which gives :-

① Iliolumbar artery :-

- ascends behind external iliac vessels, Psoas & iliacus.

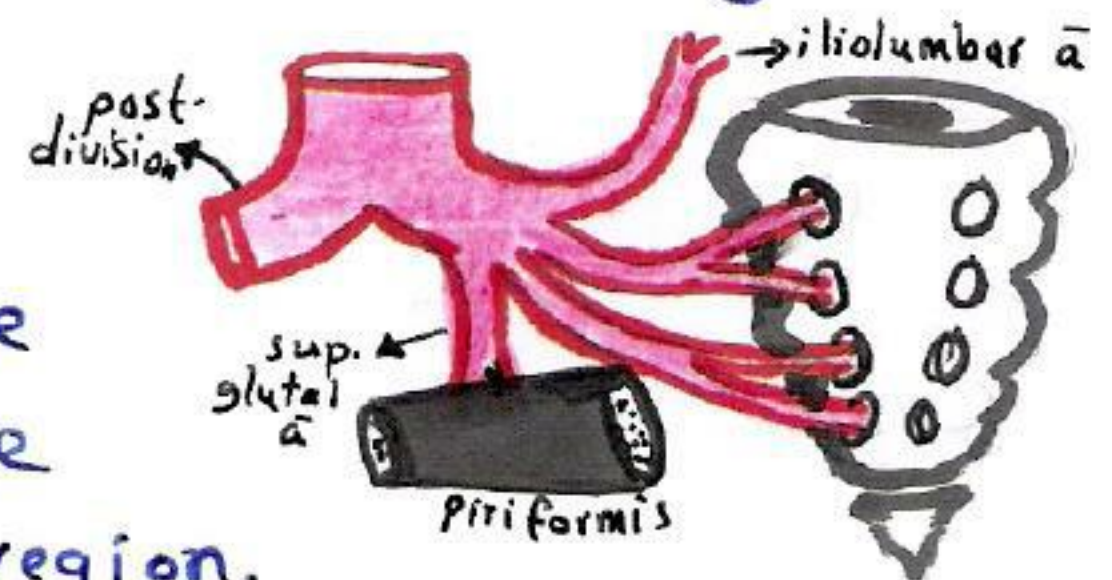
② Lateral sacral a :-

- descends in front of sacral plexus.

- They are two arteries each one gives two branches and the 4 arteries enter sacral canal through the anterior sacral foramen.

③ Superior gluteal a :-

- Leaves the pelvis through the greater sciatic foramen above piriformis muscle to gluteal region.



(B) ANTERIOR DIVISION :- which gives :-

① Inferior gluteal a :-

- Leaves the pelvis through the greater sciatic foramen below piriformis ms. (it is one of the 2 terminal br. of ant. division).

② Internal pudendal a :-

- Leaves the pelvis through the greater sciatic foramen below piriformis ms to enter the perineum through lesser sciatic foramen. (it is one of 2 terminal br. of ant. division).

③ Obturator a :-

- Leaves the pelvis through obturator canal entering into the thigh.

- It gives a pubic branch (that anastomose with pubic branch of inferior epigastric a behind body of pubis).

④ Umbilical artery:-

- It gives off superior vesical a. from proximal part where distal part is obliterated giving Medial (Lateral) umbilical ligament.

⑤ Middle rectal a.:-

- Supplies muscle of lower rectum & anastomose with the superior & inferior rectal arteries.

⑥ Inferior vesical a. (♂)

- Present only in male, & gives artery to vas deferens.
- Supplies base of bladder, prostate & seminal vesicle.

⑦ Vaginal artery:- (♀)

- Replaces the inf. vesical a. in male.
- Supplies vagina & base of bladder.

⑧ Uterine artery:- (♀)

- Runs medially & crosses the ureter above the lateral fornix of vagina.
- Ascends at lateral margin of uterus between 2 layers of broad ligament (in a tortuous manner).
- Ends at uterine tube anastomosing w. ovarian a.
- Supplies uterus, vagina & uterine tube.

NB :- all above mentioned arteries present in true pelvis

NB : false pelvis contains: ① common iliac a.

② - External iliac a.

VEINS OF PELVIS

- ① Median sacral veins.
- ② Superior rectal vein
- ③ Ovarian vein.
- ④ Internal iliac vein.
- ⑤ External iliac vein.

External iliac vein:

- Begins:- behind inguinal ligament as continuation of femoral vein.
- Courses:- along medial side of external iliac artery.
- Ends:- by joining int. iliac vein to form common iliac V.
- Tributaries:- are ① inferior epigastric vein.
② Deep circumflex iliac vein.

Internal iliac vein:

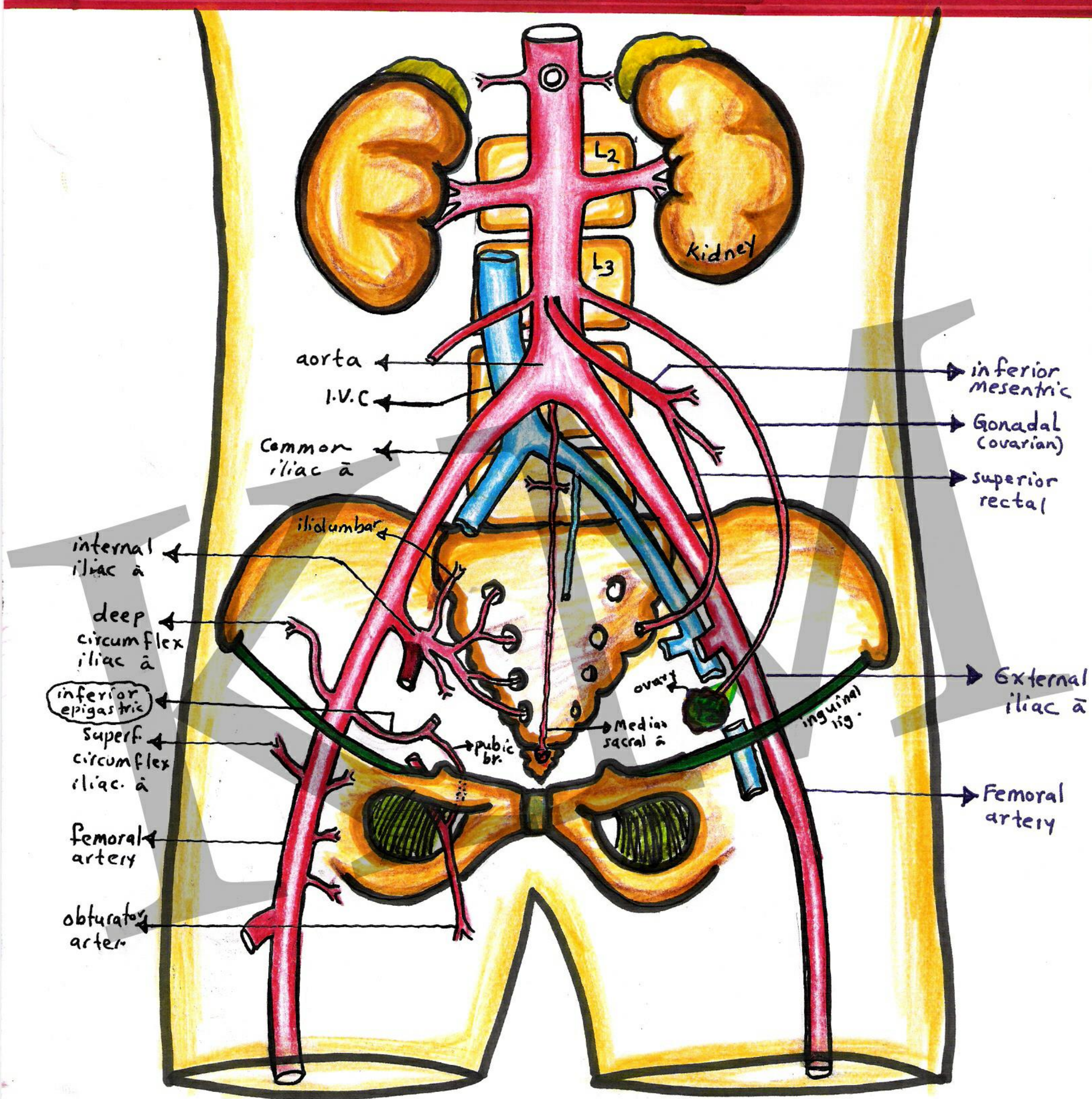
- Begins:- joining of veins corresponds to artery branches.
- Courses:- upward in front of sacroiliac joint.
- Ends:- by joining external iliac to form common iliac V.

Median sacral veins:

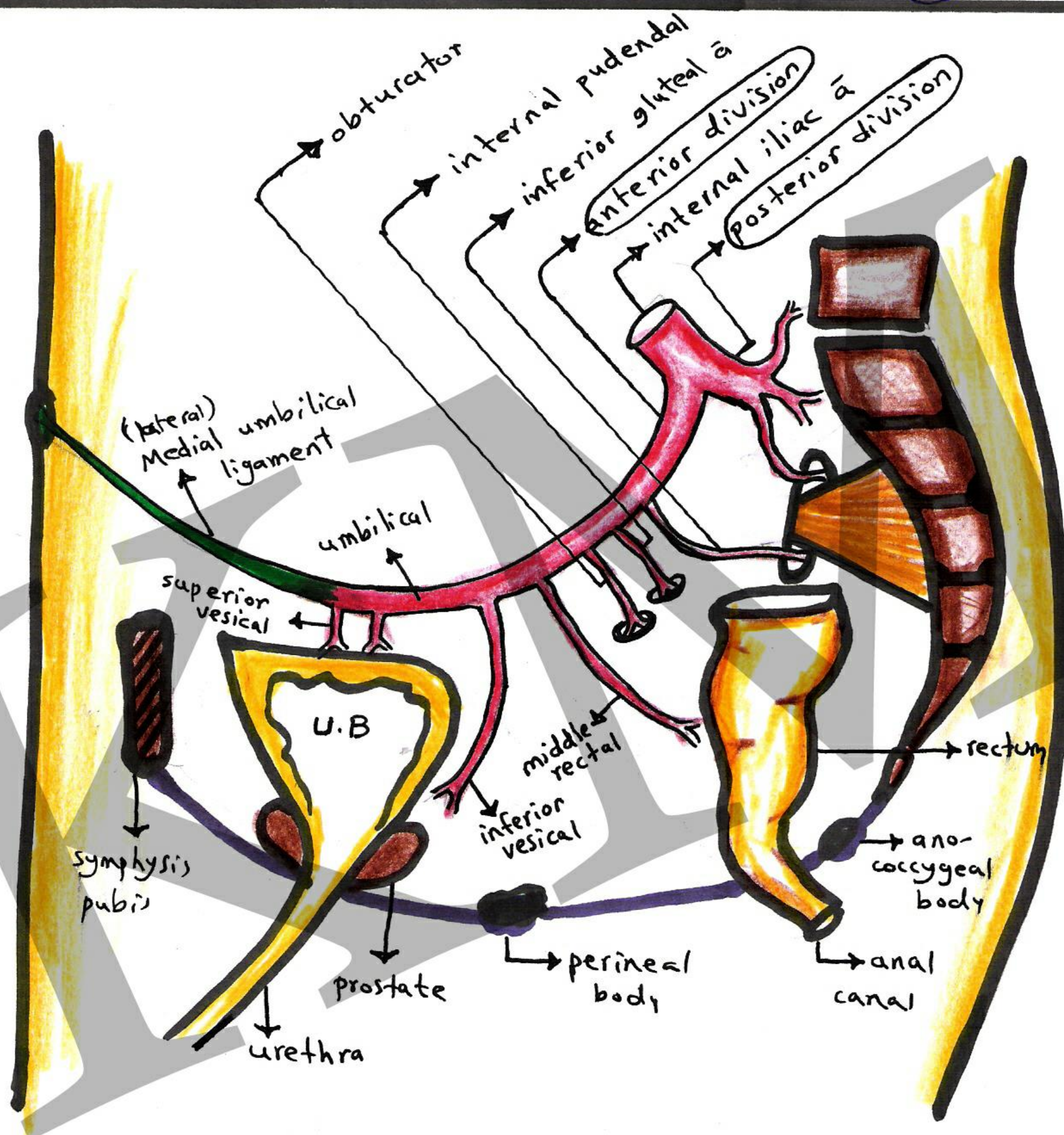
- Accompany median sacral artery.
- Ends by joining Left common iliac vein.

LYMPH OF PELVIS

- ① External iliac lymph nodes.
- ② Internal iliac LN.
- ③ Common iliac LN.



Arteries of Pelvis ----



**** Internal iliac artery.**

NERVES OF PELVIS

I LUMBAR PLEXUS

- Formed in the abdomen (inside substance of psoas major ms) by ventral rami of 1st 4 lumbar nerves
- Branches

① iliohypogastric (L ₁)	⑤ - femoral N. (L _{2,3,4})
② ilio inguinal (L ₁)	⑥ - obturator N. (L _{2,3,4})
③ Genito femoral (L _{1,2})	⑦ Lumbosacral trunk (L _{4,5})
④ Lat. cut. N. of thigh (L _{2,3})	

* Branches of lumbar plexus which enters the pelvis are

① LUMBOSACRAL TRUNK :-

- formed by anterior (ventral) rami of L₄ and L₅ which join each other (medial to psoas major ms)
- It crosses in front of sacroiliac joint (together with obturator nerve) to enter pelvis.
- It joins sacral plexus.

② OBTURATOR NERVE :-

- formed by ventral rami of L_{2,3,4} pass medial to psoas major ms & crosses in front of sacroiliac joint.
- Divides into anterior & posterior divisions on reaching obturator canal
- Passes through obturator canal into medial (adductor) compartment of thigh.
- In pelvis it gives sensory branches that supply parietal peritoneum (at lateral pelvic wall).

II- SACRAL PLEXUS

- Formed in pelvis, in front of piriformis muscle.
- Formed by anterior rami of L₄, L₅ (Lumbosacral trunk) and anterior rami of S₁, 2, 3, 4 [L₄, 5, S₁, 2, 3, 4]
- Related - posteriorly to piriformis and anteriorly to parietal pelvic fascia (separating it from internal iliac a.).

* Branches :-

(A) From the root

- Muscular : to piriformis (S₁, 2), Levator ani & coccygeus (S₄).
- Splanchnic (parasymp.) nerves (S₂, 3, 4) to pelvic viscera.

(B) From ventral surface

- Nerve to quadratus femoris (L₄, 5, S₁) : supply quadr. femoris and inferior gemellus.
- Nerve to obturator internus (L₅, S₁, 2) : supply obturator internus and superior gemellus.

(C) from dorsal surface

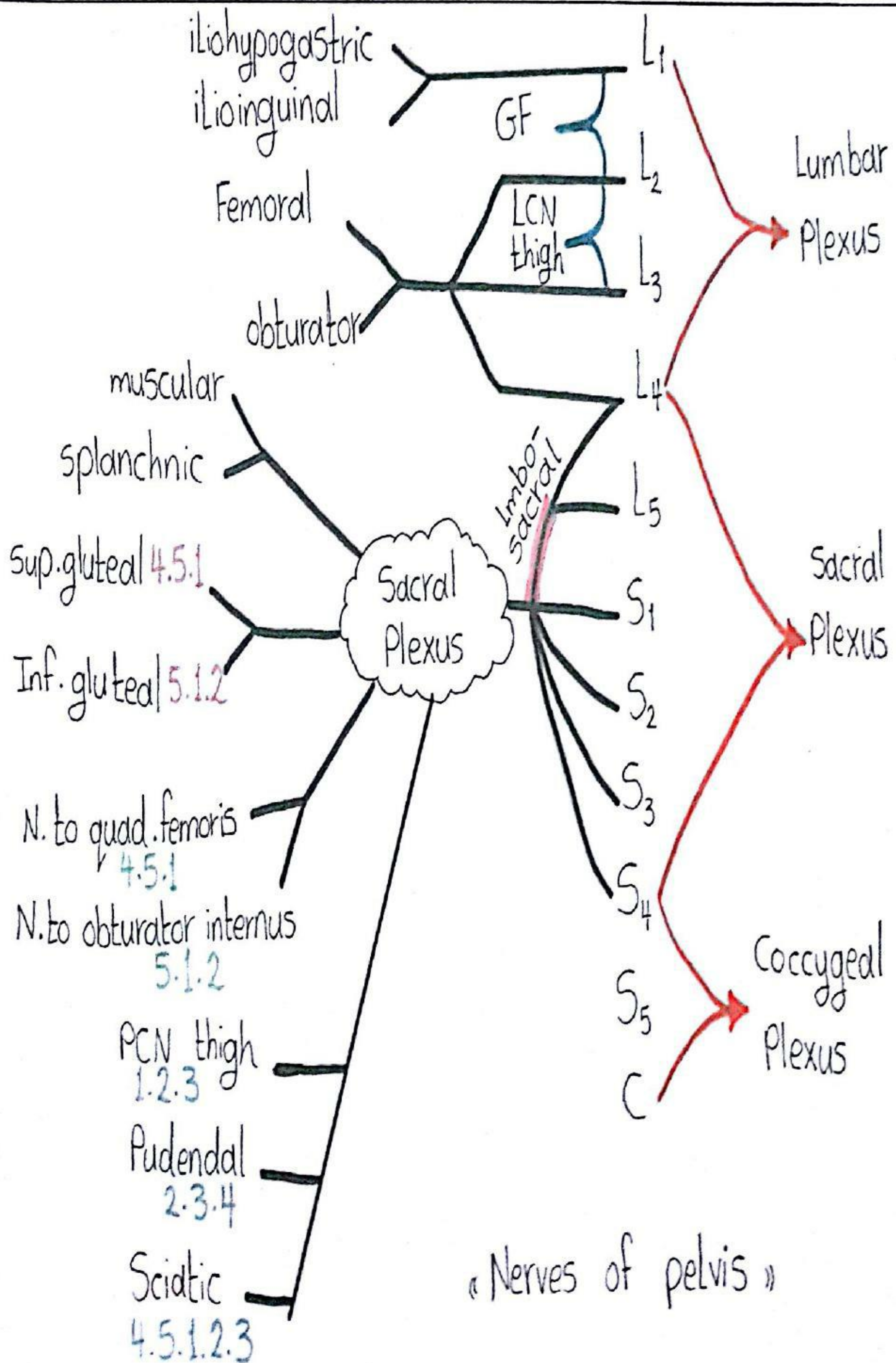
- Superior gluteal N. (L₄, 5, S₁) : supply gluteus medius and minimus & tensor fascia lata.
- Inferior gluteal N. (L₅, S₁, 2) : supply gluteus maximus.

(D) from both (ventral & dorsal)

- Sciatic Nerve :- (L₄, 5, S₁, 2, 3) : "Largest N. of body".
- Post. cut. N. of thigh (S₁, 2, 3) : supply skin of buttock & thigh ^{back of}
- Pudendal nerve (S₂, 3, 4) : It leaves pelvis through greater sciatic foramen to enter perineum through Lesser sciatic forame (together with internal pudendal vessels).

NB: ALL branches of sacral plexus leaves pelvis through Greater sciatic foramen : EXCEPT branches of the root (ms. & splanchnic) stay in pelvis.

Coccygeal PLEXUS :- formed by ventral rami of S₄, S₅ and coccygeal nerve, gives ano. coccygeal nerve that supplies levator ani, coccygeus & skin over coccyx



III. AUTONOMIC NERVES

① PELVIC SYMPATHETIC TRUNK :-

- Beginning :- as continuation of abdominal part of symp. Trunk, crosses in front of ala of sacrum, behind the common iliac vessels.
- Course :- ^(relation) runs in front of sacrum, medial to the anterior sacral foramina, behind rectum.
- Ends :- by union of 2 trunks in front of coccyx forming "ganglion impar"
- Branches :- ① Gray rami communicantes to the sacral & coccygeal nerves.
② fibers joining hypogastric plexus

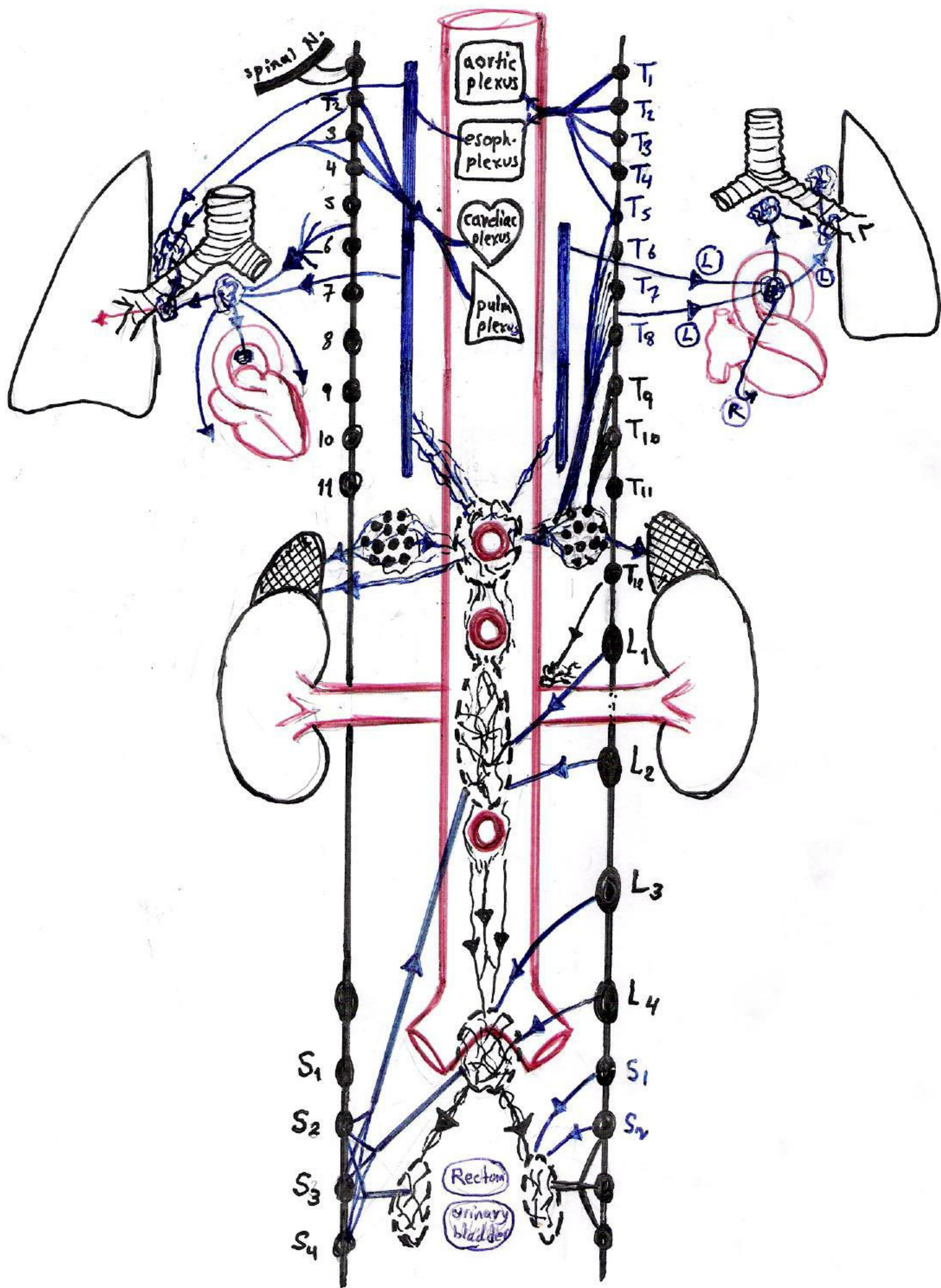


② PELVIC SPLANCHNIC NERVES :- (Parasymp.)

- Beginning :- from S_{2,3,4} (that give preganglionic fibers)
- Course :- synapse in inferior hypogastric plexus (or in walls of viscera) and some ascend into the inferior mesenteric plexus.
- Ends :- by distributed along branches of inferior mesenteric artery to hindgut.

*AUTONOMIC PLEXUSES OF PELVIS :

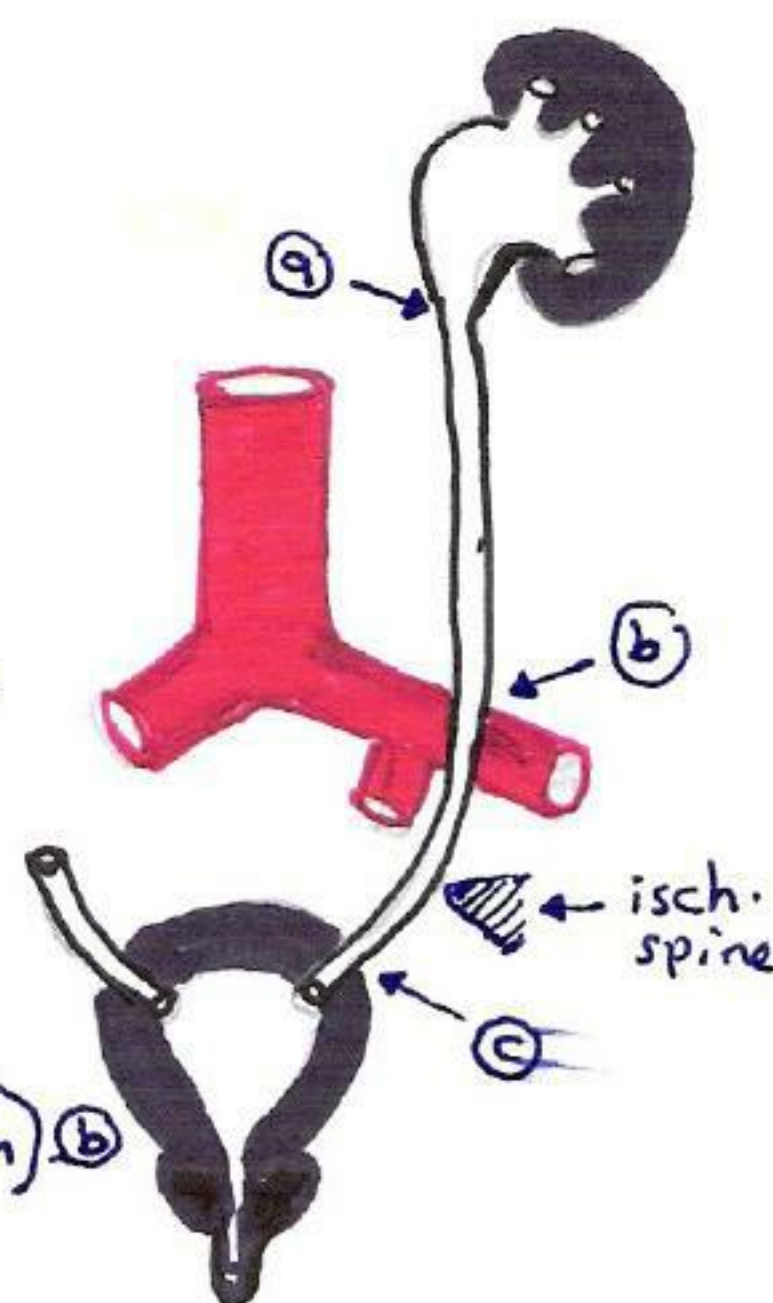
	superior hypogastric plexus	inf. hypogastric plexus
site	in front of sacral promontory	at sides of pelvic viscera
formation	① Continuation of aortic plexus ② br. from L _{3,4} symp. ganglion	① hypogastric nerve (sup. hypogastric plexus) ② Pelvic splanchnic N. (S _{2,3,4})
Contents	① Sympathetic nerve fibers ② Parasymp. N. fibers. ③ visceral afferent N. fibers	① symp. N. fibers (Postganglionic) ② Parasymp. N. F. (Pre & post " ③ visceral afferent N. fibers
End.	hypogastric nerves (Rt & Lt)	branches to pelvic viscera (via small subsidiary plexuses)



URETER

* DESCRIPTION :

- The ureter is 10 inches (25 cm) long, half of it in the abdomen proper & lower $\frac{1}{2}$ in pelvis.
- The ureter is divided into 3 parts:
 - ① abdominal part.
 - ② pelvic part (after crossing common iliac artery).
 - ③ intramural part (inside wall of urinary bladder).
- The ureter has 3 constrictions:
 - ① At pelvi-ureteric junction. (a)
 - ② At crossing of common iliac artery (at pelvic brim) (b)
 - ③ Intramural part (narrowest portion).



* COURSE :

- The ureter starts as a continuation of renal pelvis (at lower border of kidney) and runs at ant. surface of Psoas major (retroperitoneal) then enters the pelvis by crossing the ^{sacro-iliac joint} beginning of the external iliac artery (crossing bifurcation of common iliac).
- Then the ureter runs backward, downward along the lower border of internal iliac a till the ischial spine where it curves forward & medially to enter the postero-superior angle of bladder.

* RELATION:

I. POSTERIOR: the 2 ureters are related posteriorly to:

- psoas major & minor^(a) and genito femoral N.^(b)
- Ext. iliac artery^(c) & vein^(d)
- obturator N.^(e)
- obturator artery^(f) & vein^(g) (respectively)
(Psoas separate it from lumbar transv. processes).

II. ANTERIOR:

Rt ureter

- ① Third part of duodenum & root of mesentery.
- ② R gonadal vessels
- ③ Rt colic vessels
- ④ ilio colic vessels
- ⑤ ileum (terminal part)

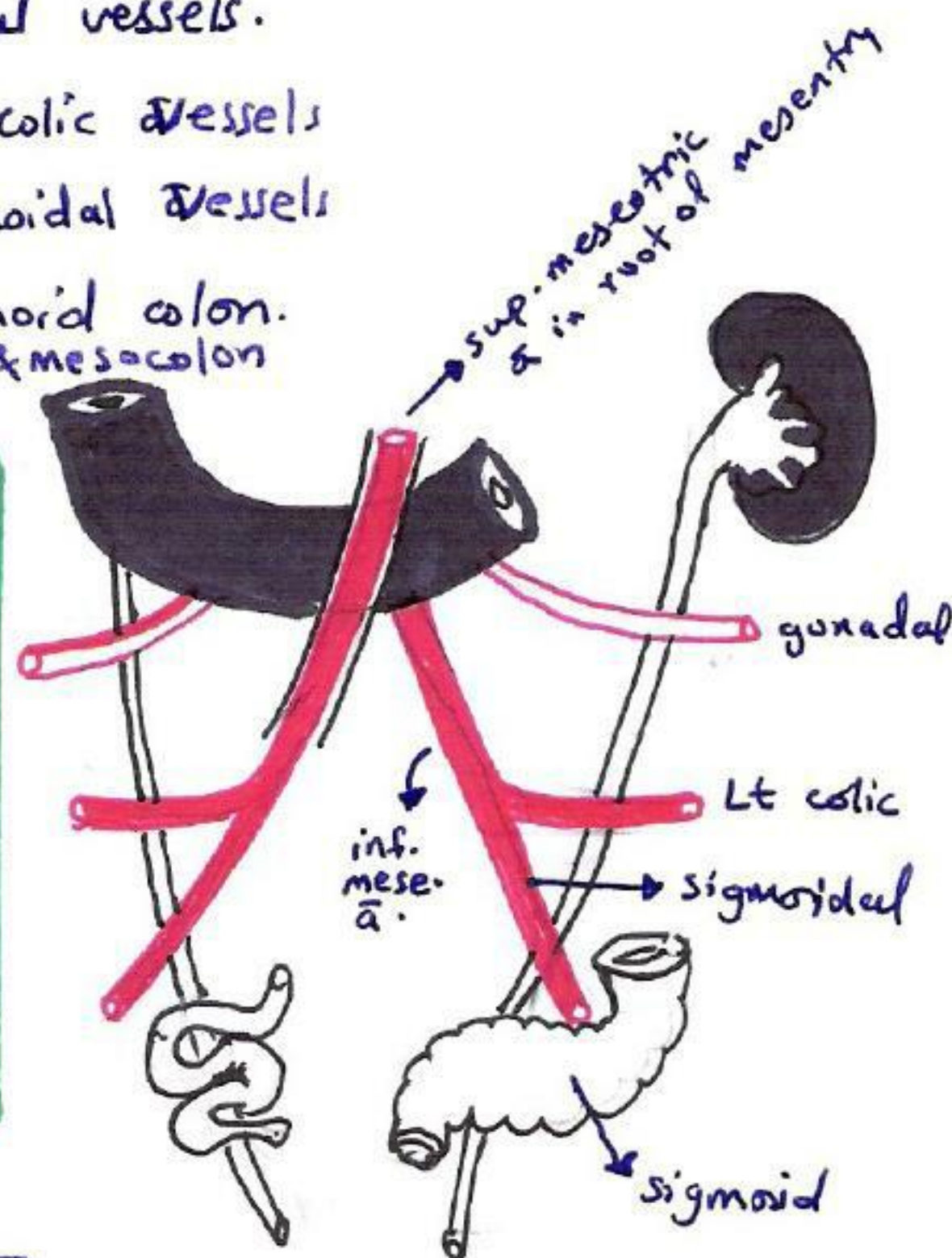
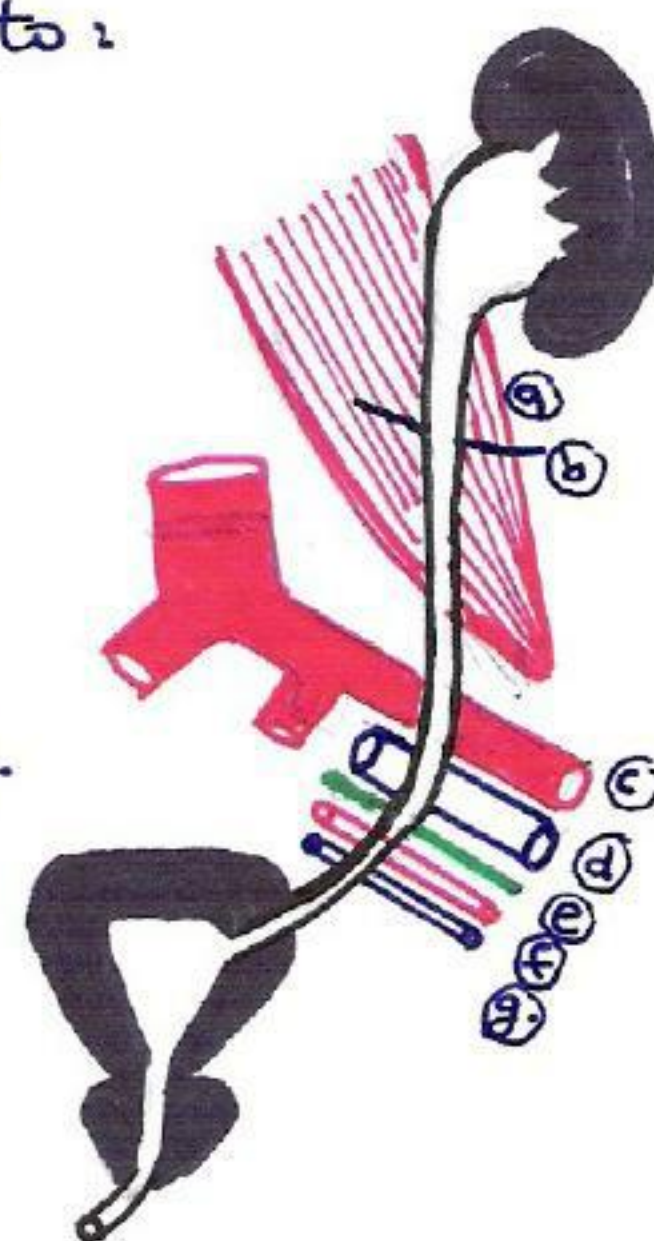
Lt ureter

- ① gonadal vessels.
- ② Lt colic vessels
- ③ sigmoidal vessels
- ④ sigmoid colon & mesocolon

[NB] Both ureters are crossed in the pelvis by:

- vas deferens in male or
- uterine artery in female.

[NB] inferior mesenteric vein lies along medial side of the left ureter



* Blood supply:

[Lymph] → into lateral aortic & iliac LN.

- upper end: renal artery. (N/S from renal plexus)
- Middle part: gonadal artery. (N/S from gonadal plexus)
- in pelvis: superior vesical artery. (N/S from sup. vesical plexus)
 - afferent fibers travel with symp. enter spinal cord at L₁, L₂

CLINICAL NOTES

● RECTAL PROLAPSE :

- It is a downward displacement of rectum through anus, either ① Partial (only mucosa) or ② complete (all thickness)
- May be caused e.g by childbirth & poor muscle tone.

● UTERINE & VAGINAL PROLAPSE :-

- It is a downward displacement of uterus & vagina as they always occur together, or vagina alone.

● Cystocele :-

- Bulging of anterior vaginal wall due to sagging of bladder

● Rectocele :-

- Bulging of post. vaginal wall due to sagging of rectal ampulla

● Culdocentesis :-

- It is the passage of a needle through post. fornix of vagina to drain pelvic abscess, it also may drain blood inside peritoneal cavity (Douglas pouch).

● Perforation of post. vaginal fornix :-

- It may be caused by ① iatrogenic during operation of dilatation & curettage (D&C) ② attempt of abortion by non-sterile instrument (which may be fatal by causing peritonitis)

● Pelvic inflammatory disease :-

- Is chronic disease caused by acute infection of Parametrium (Pelvic fascia around cervix of uterus) from uterus & vagina.

• Vaginal examination :-

- PV (Per-vaginal) examination to feel :-

(1) Anteriorly :- bladder & urethra.

(2) Posteriorly :- Douglas pouch (containing ileum & sigmoid colon), rectal ampulla & perineal body.

(3) Laterally :- uterus, pelvic fascia, levator ani (ant. fibers), and urogenital diaphragm.

• Tubal Ligation :-

- Ligation & division of uterine tube is a method of permanent birth control.

- If later on continuity is restored, fertilization may occur in 20% of women.

• Pregnancy & hemorrhoids :-

- During pregnancy hemorrhoids (Piles) and varicose veins increased due to

(1) Pressure of Gravid uterus on I.V.C.

(2) ↑ progesterone level → smooth ms relaxation in B.V.

• Hysterectomy :-

- Is surgical removal of uterus.

• Infection spread :-

- Infection may ascend from vagina → to uterus → to uterine tube (salpingitis) → to Peritoneal cavity (Peritonitis).

• Pressure at sacral plexus :-

- Pressure at sacral plexus by fetal head during last stages of pregnancy may → lead to discomfort or aching pain extending to lower limb (improved by changing position in bed).

- Also rectal carcinoma may → lead to invasion of sacral plexus → lead to severe intractable pain.

• Pelvic appendix :-

- Inflamed appendix (appendicitis) may hang into pelvis which \rightarrow rectal or vaginal tenderness and may perforate \rightarrow Pelvic peritonitis.
- Appendicitis may irritate obturator nerve \rightarrow referred pain to medial side of thigh.

• Perianal abscess :-

- (1) Submucous abscess:- Localized to submucosa.
- (2) Subcutaneous abscess:- under perianal skin.
- (3) Ischiorectal abscess:- confined to the fossa.
- (4) Horse shoe abscess:- abscess of both ischial fossae and communicated posterior to anal canal.
- (5) Pelvi-rectal abscess:- between rectal ampulla and the upper surface of levator ani

• Anal fistula :- ^{two epithelium}

- Tract between ① skin around anus & ② lumen of anal canal or lower rectum

• Anal Sinus :-

- abscess opens only onto one surface (epithelium).

• Lower GIT endoscopy :-

- It can be proctoscopy (for rectum), sigmoidoscopy or colonoscopy that used for ① Diagnosis of cancer, bleeding, inflammatory bowel disease, ...etc) or for ② treating some disease (e.g bleeding ...etc) and for ③ taking biopsy.

• Cystoscopy :-

- Endoscopy of bladder, used to inspect bladder & its details as ureteric orifices (appear as slitlike, that eject a drop of urine every minute).

• Bladder capacity :-

- Is about 500 ml but can be up to 1000 to 1200 ml

● Urinary retention :- (inability to pass urine) :-

- retention of urine is more common in male e.g. by ① Benig enlargement of prostate :- in >50 years due to hormonal imbalance.
- ② Urethritis and prostatitis and stones.
- ③ Cancer in bladder or prostate.

● Urinary incontinence :- (inability to control urine) :-

- Stress incontinence is a condition of partial incontinence occurs when patient coughs, strains or laugh excessively
- caused by weak sphincter (by difficult labour, or loss of tone of levator ani ms).

● Treatment of urine retention :-

- Treated by catheterization through urethra, if failed \rightarrow do supra pubic aspiration by passing needle into bladder through anterior abdominal wall above symphysis pubis (without entering peritoneal cavity as bladder when fills bulges into abdomen separating the peritoneum from ant. abd. wall).
- N.B :- bladder is abdominal & pelvic organ in children and if full in adult.

● Bimanual examination of rectum :-

- Done by inserting gloved index in anal canal and either ① another finger in vagina in female or ② the other hand at lower abdominal wall above symphysis pubis (bladder empty)
- Used to diagnose rectal carcinoma or other pathology.

● Rectal examination :-

- P/R :- per-rectal exam. of rectum by gloved index may feel enlarged prostate (benign or malignant enlargement).

JOINTS OF PELVIS

(1) SACRO-ILIAC JOINT :

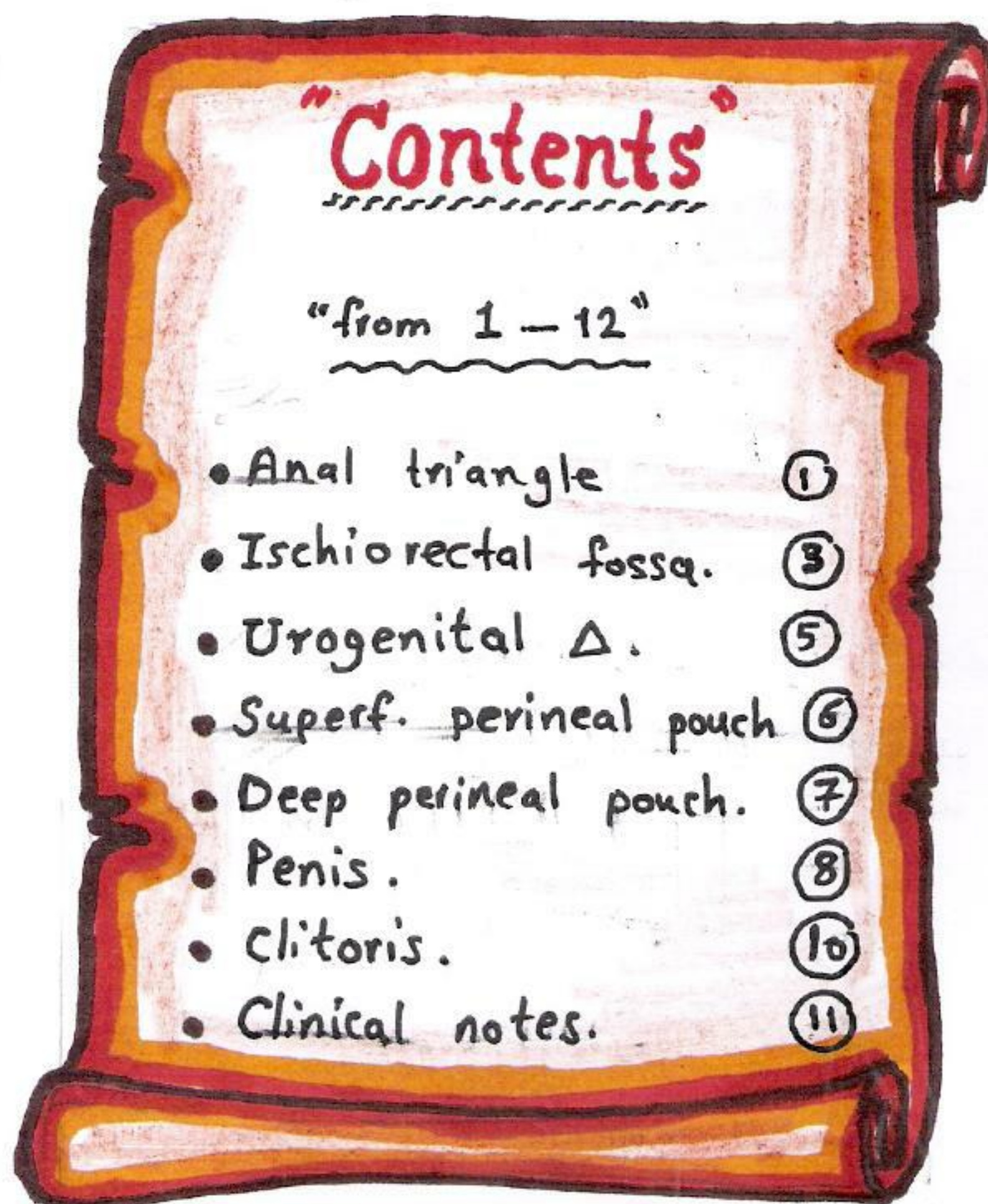
- * **Articulation** :- bet. articular surfaces of sacrum & iliac bones.
- * **Type** :- very strong synovial plane joint.
- * **Ligament** :- ① Anterior sacroiliac Lig. (thin).
 ② Posterior sacroiliac Lig.
 ③ accessory ligaments : which are :
 - Sacrospinous & sacrotuberous Lig.
 - Ilio-lumbar lig (bet iliac crest & 5th lumbar transverse process).
- * **Movement** : little.
- * **Nerve supply** :- branches of sacral spinal nerves.

(2) SACRO-COCYGEAL JOINT :

- * **Articulation** :- between 5th sacral vertebra & 1st coccygeal vertebra.
- * **Type** :- Secondary cartilagenous joint.
- * **Ligaments** :- sacrococcygeal lig. between ^{cornua of} coccyx & cornua of sacrum
- * **Movement** :- Great deal of movement is possible.

(3) SYMPHYSIS PUBIS :-

- * **Articulation** :- between the 2 pubic bones which are connected by fibrocartilage [The articular surfaces covered by hyaline cartilage].
- * **Type** :- Secondary cartilagenous joint.
- * **Ligaments** :- extend from one pubic bone to the other.
- * **Movement** :- almost no movement is possible.



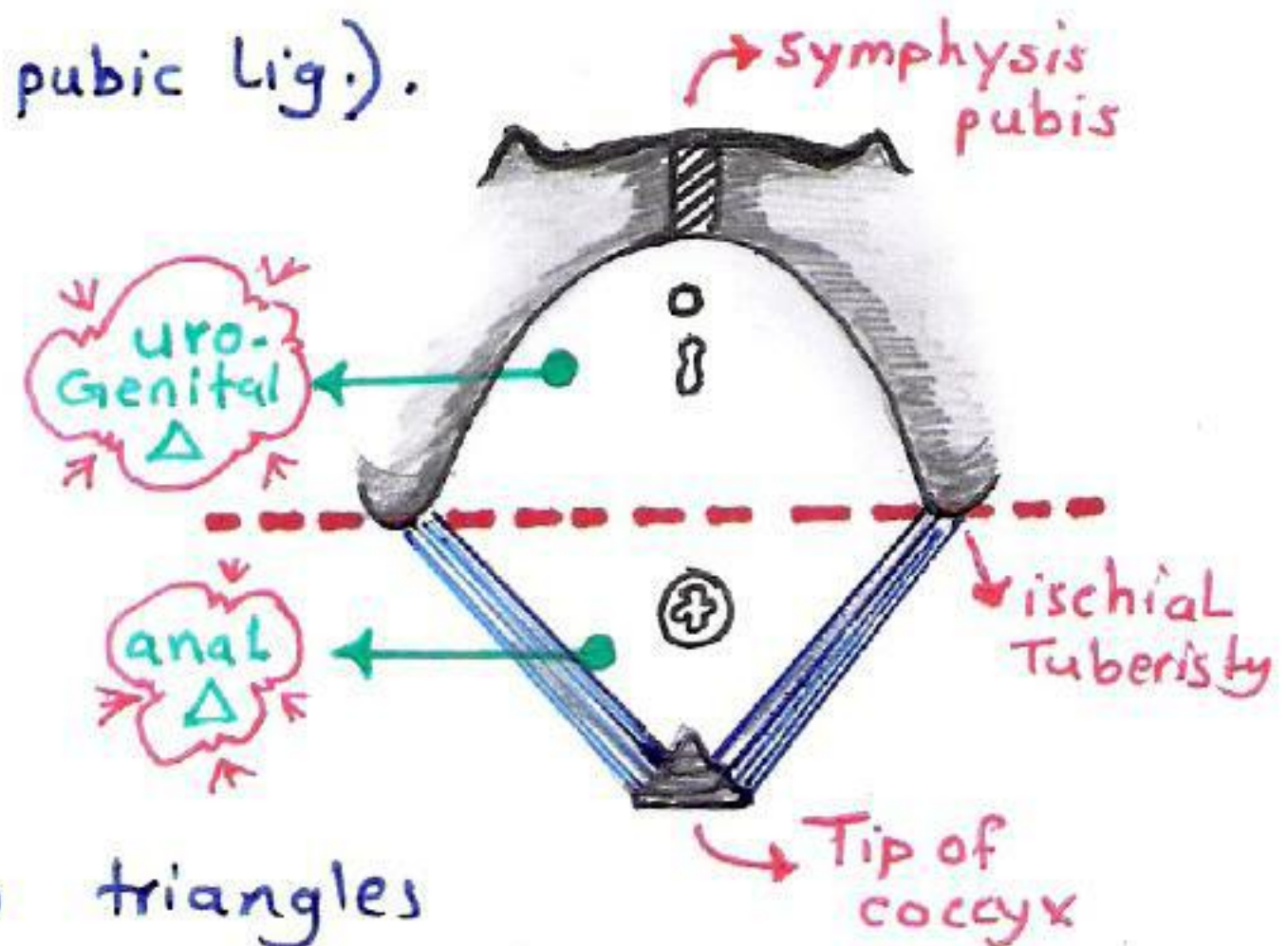
PERINEUM

①

- Perineum is the part of pelvic cavity below the pelvic diaphragm.
- It is diamond in shape (when seen from below).

* Boundaries of Perineum :-

- Anterior:- symphysis pubis (inf. pubic lig.).
- Posterior:- Tip of coccyx
- Lateral:- ischial tuberosities.
- Anterolateral:- pubic arch.
- Posterolateral:- Sacrotuberous lig.



* Divisions of Perineum :-

- Perineum is divided into two triangles by an imaginary line between two ischial tuberosities:
- ① Urogenital triangle (anteriorly):- Contains urethra & ext. genital organs.
- ② Anal triangle (posteriorly):- Contains anal canal & ischiorectal fossae.



- Anal Δ contains anal canal & ischiorectal fossae.

ANAL CANAL

- It is about 4 cm (1½ inches) long
- Begins as a continuation of rectal ampulla 1 inch in front of tip of coccyx [at anorectal junction].
- It passes downward, backward (and always closed except at defecation), ends at anus (lower opening).

- * Relation:-
 - anterior:- Perineal body & urogenital diaphragm.
 - Posterior:- ano-coccygeal body.
 - Lateral:- ischio-rectal fossa.

- Anal canal contains muscle coat consisting of:

- ① outer longitudinal layer of smooth ms.
- ② Inner circular layer of smooth ms.

* Anal sphincter :-

① Internal sphincter :- (involuntary):

- covers upper 2/3 of anal canal, (N/s by autonomic N.)
- It is thickening of circular layer of smooth ms.

② External sphincter : (voluntary):

- covers lower 2/3 of anal canal.
- It is formed of skeletal ms & divided into:
 - (A) Subcutaneous part: at lower part. (has no bone attachment).
 - (B) Superficial part: attached to perineal body & coccyx.
 - (C) deep part: at upper part (has no bone attachment).
- external sphincter supplied by • inf. rectal N. (Pudendal N.)
• Perineal br. of S₄ nerve.

* Anal mucosa :-

- Anal mucosa differs in upper 1/2 from lower 1/2.

	Upper 1/2 of anal canal	Lower 1/2
origin of m.m	mucous membr. derived from endoderm of hindgut	Skin derived from ectoderm of proctodeum.
Lining of anal canal	Lined by columnar epith. which forms <u>anal columns</u> (vertical folds) which joined by <u>anal valves</u> (semicircular folds joining lower ends of anal columns).	- Lined by stratified sq. epithelium. - No anal columns - No anal valves.
N/s	- supplied by autonomic nerves (hypogastric plexus). - Sensitive only to stretch.	- by somatic nerves (inferior rectal nerve). - Sensitive to Pain, Pressure, Touch, Temperature.
artery supply	- supplied by superior rectal a (from Inf. mesenteric a).	- by inferior rectal artery (from internal pudendal a)
vein drain	- drained by superior rectal v (into Inf. mesenteric v) → Portal	- into inf. rectal vein (into - int. pudendal v) → into int. iliac v → Systemic
Lymph drain	- by sup. rectal LN → Para-rectal nodes → inf. mesenteric LN	- superf. ing. LN (medial group)

* Anal muscles :- (ms coat):

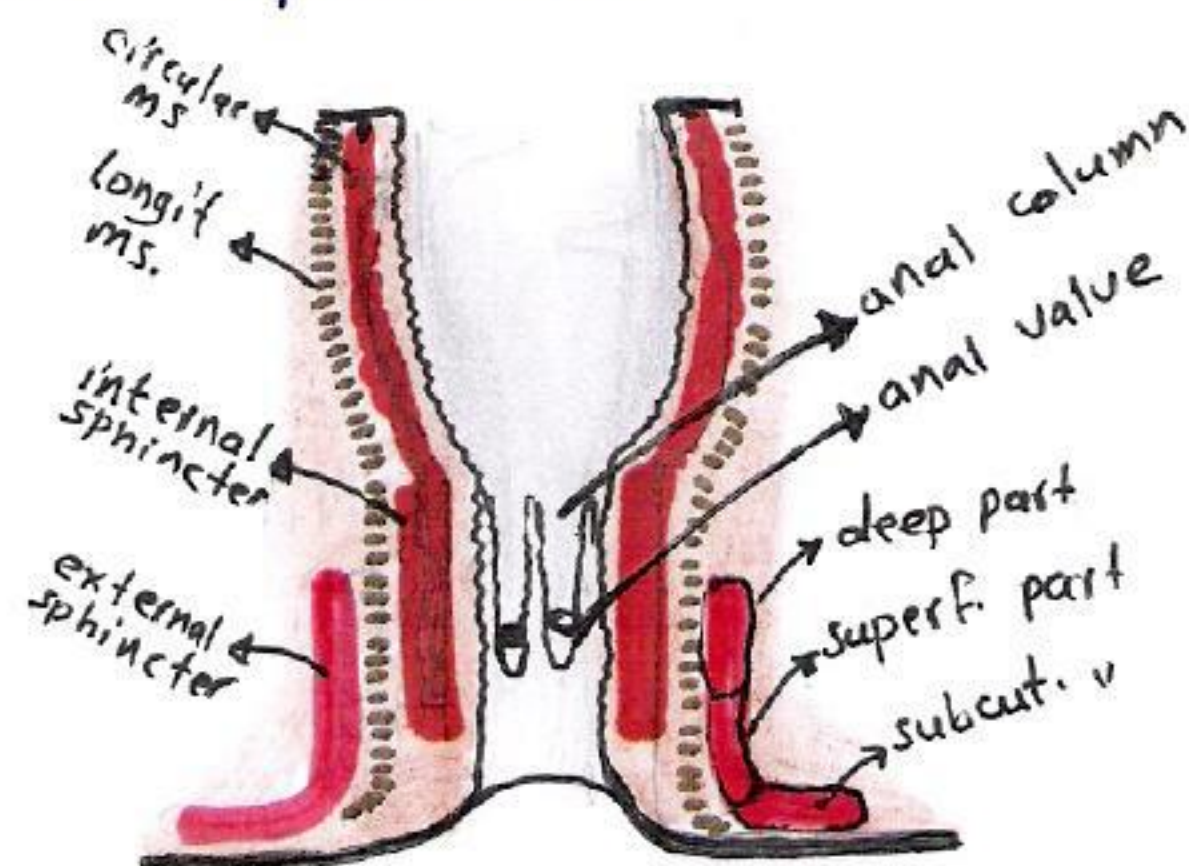
- ① Inner circular layer of smooth ms:- which thickened to form internal sphincter.
- ② Outer longit. layer of smooth ms:- which continuous above with that of rectum & descends in interval between internal & external anal sphincters

• ANORECTAL RING:-

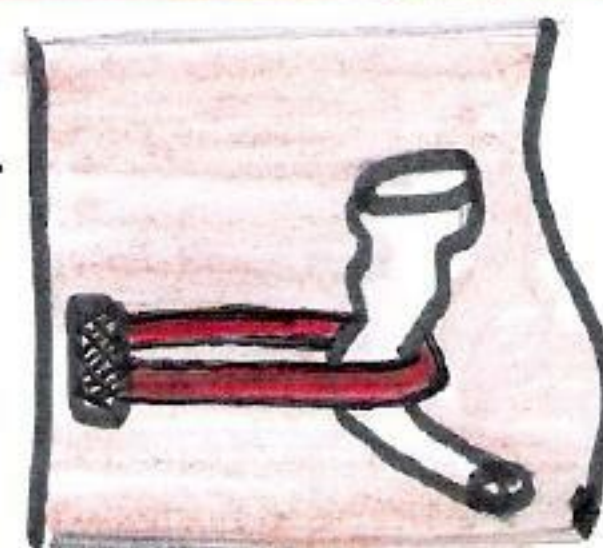
- is formed by union of :-

- ① internal sphincter.
- ② deep part of ext. sphincter.
- ③ Puborectalis muscle

- It can be felt on rectal examination



- NB:- Puborectalis fibers of 2 Levator ani blend with deep part of ext. sphincter forming U-shaped sling that attached in front to pubic bones & behind at ano rectal junction → forming acute angle by pulling it forward.



ISCHIO-RECTAL FOSSA

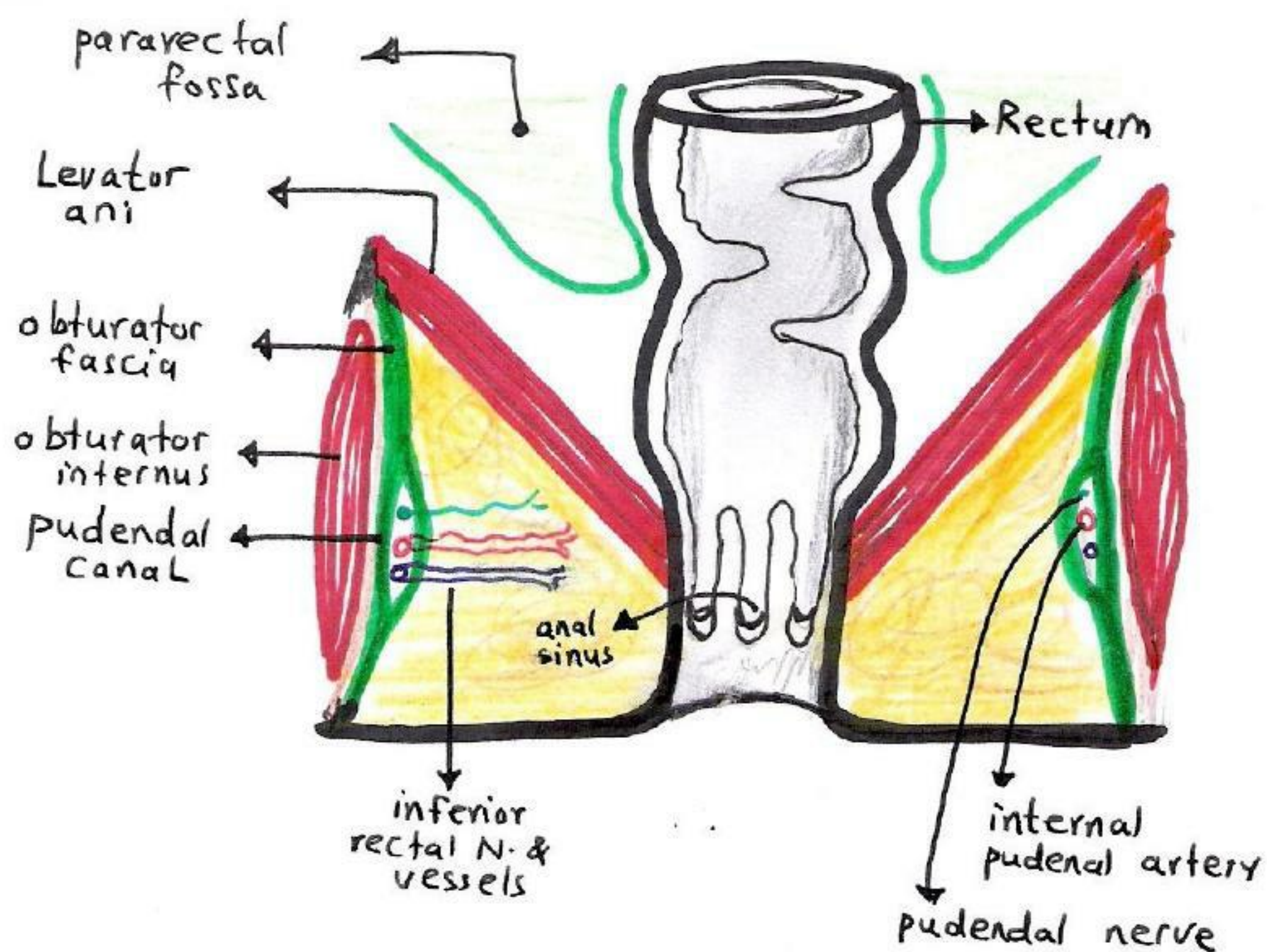
- It is a wedge-shaped space at each side of anal canal.

* Boundaries :-

- Medial wall :- Levator ani & anal canal.
- Lateral wall :- Obturator internus, obturator fascia & Pudendal canal.
- Base (inferior) :- Skin.
- Apex (:Superior) :- Junction of medial & lat. walls.
- Posterior :- sacrotuberous ligament.
- Anterior :- superficial & deep transv. perineal muscles.

* Contents :-

- ① dense fat.
- ② Inferior rectal nerve & vessels.
- ③ Pudendal nerve & int. pudendal vessels (inside pudendal canal).



* Pudendal canal :-

- **NB** :- Pudendal canal is a tunnel formed by splitting of obturator fascia.
- Contains Pudendal nerve & internal pudendal vessels that give inferior rectal nerve & vessels respectively
- Inferior rectal N. & vessels runs medially inside the ischio-rectal fossa to supply anal canal (lower $\frac{1}{2}$).
- Ends by opening into the deep perineal pouch.

* Clinical note :-

- Perianal (ischio-rectal) abscess :- is formed by infection to the fossa with Pus formation as fat is a good media for infection.

* **NB** :- Branches of Pudendal nerve are :-

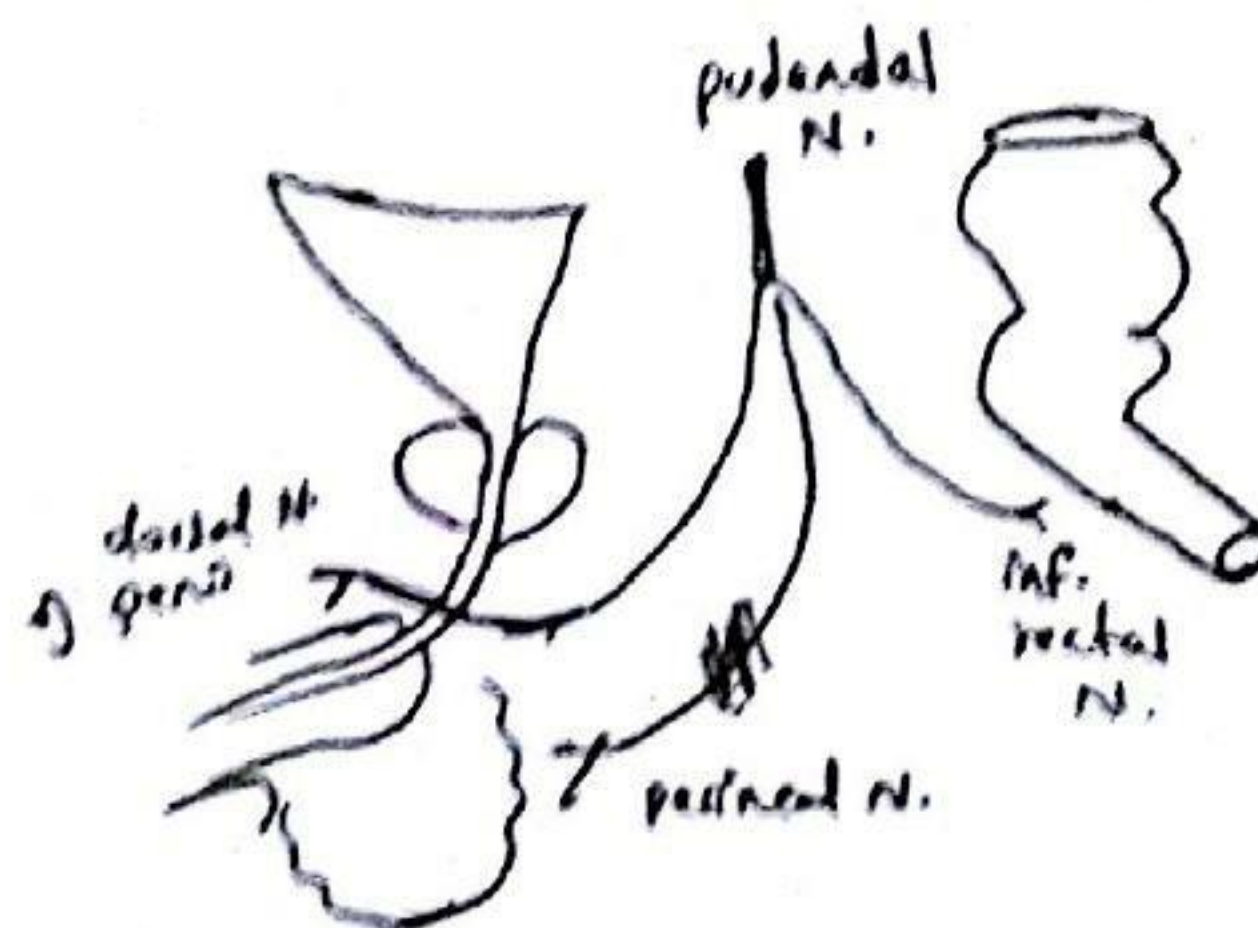
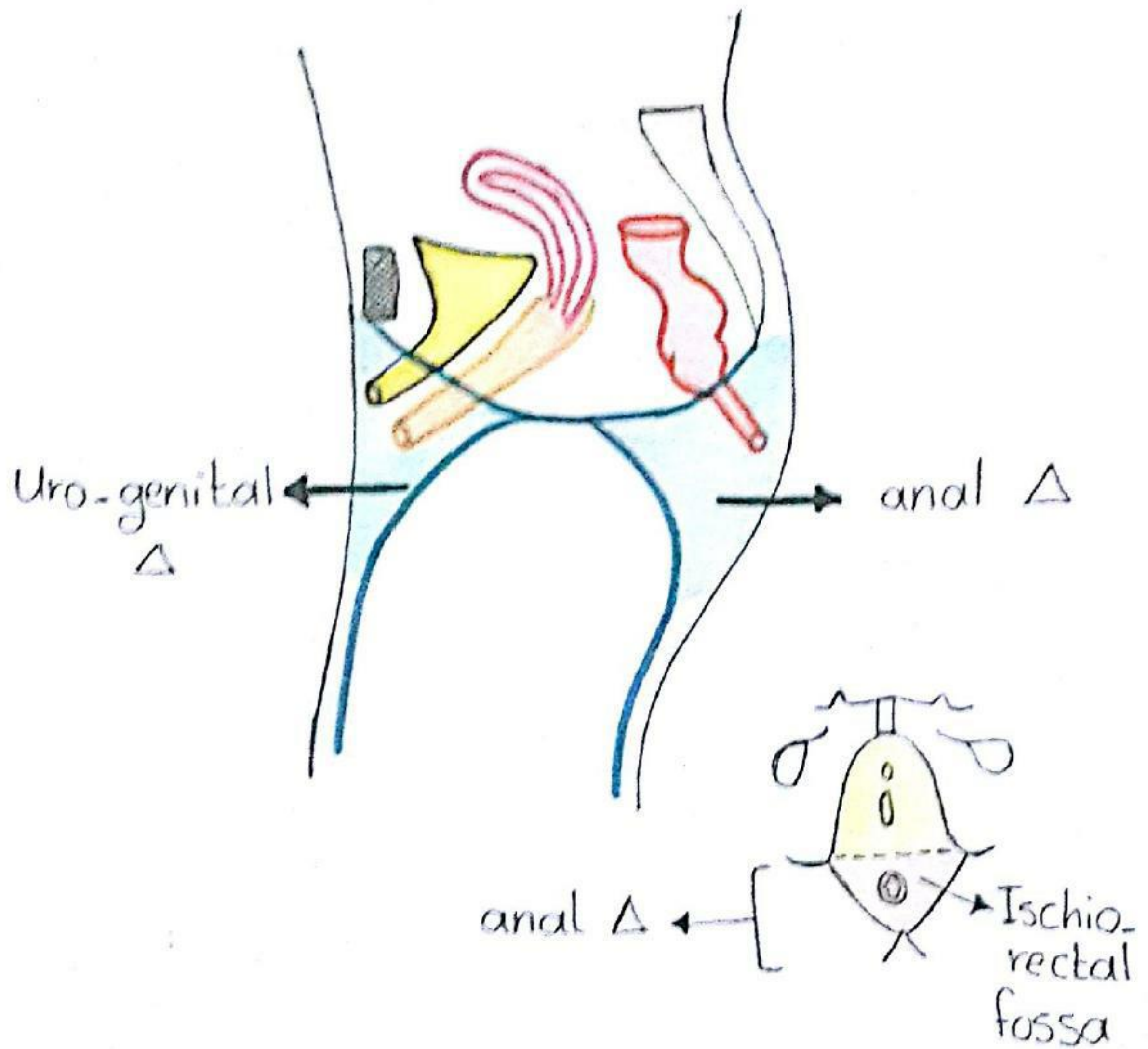
I - inferior rectal N. supplies

- ① Lower $\frac{1}{2}$ of anal canal ~~muscle~~.
- ② External sphincter.
- ③ Perianal skin.

II - Dorsal N. of penis (or clitoris).

III - Perineal nerve supplies ① ms. of urogenital Δ . ② skin on post. surface of the scrotum (or labia majora).

PERINEUM



UROGENITAL Δ

* Boundaries :-

-(Ant):- Pubic arch, (Lat):- ischial tuberosities.

* Contents :-

-(Male):- Penis & scrotum.

-(Female):- external genitalia.

- orifices of urethra & vagina.

* Notes :-

■ The urogenital Δ contains 3 membranes :-

① Membranous layer of superficial fascia [superficial]

② Perineal membrane [in middle].

③ Pelvic fascia [deep].

■ The urogenital Δ is occupied by 2 perineal pouches:-

① superficial pouch:- between perineal membrane (deep) & membranous layer of sup. fascia (superficial to it).

② Deep pouch :- between perineal membrane (superf. to it) & pelvic fascia (deep to it)

■ The superficial fascia of urogenital Δ differentiated into 2 layers

① Superficial fatty layer (fascia of CAMPER):-

- Continuous with superficial fascia of the thigh and fat of ischio-rectal fossa [in scrotum replaced by dartos ms]

② Deep membranous layer (COLLES' fascia):-

- Inferiorly is continuous with membranous layer of ant. abd. wall (Scarpa's fascia).

- laterally is attached to pubic arch.

- Posteriorly : attached to Post. border of urogenital diaphragm

- Continued over the penis (or clitoris) as tubular sheath

- In scrotum (labia majora): forms distinct layer.

SUPERFICIAL PERINEAL POUCH:

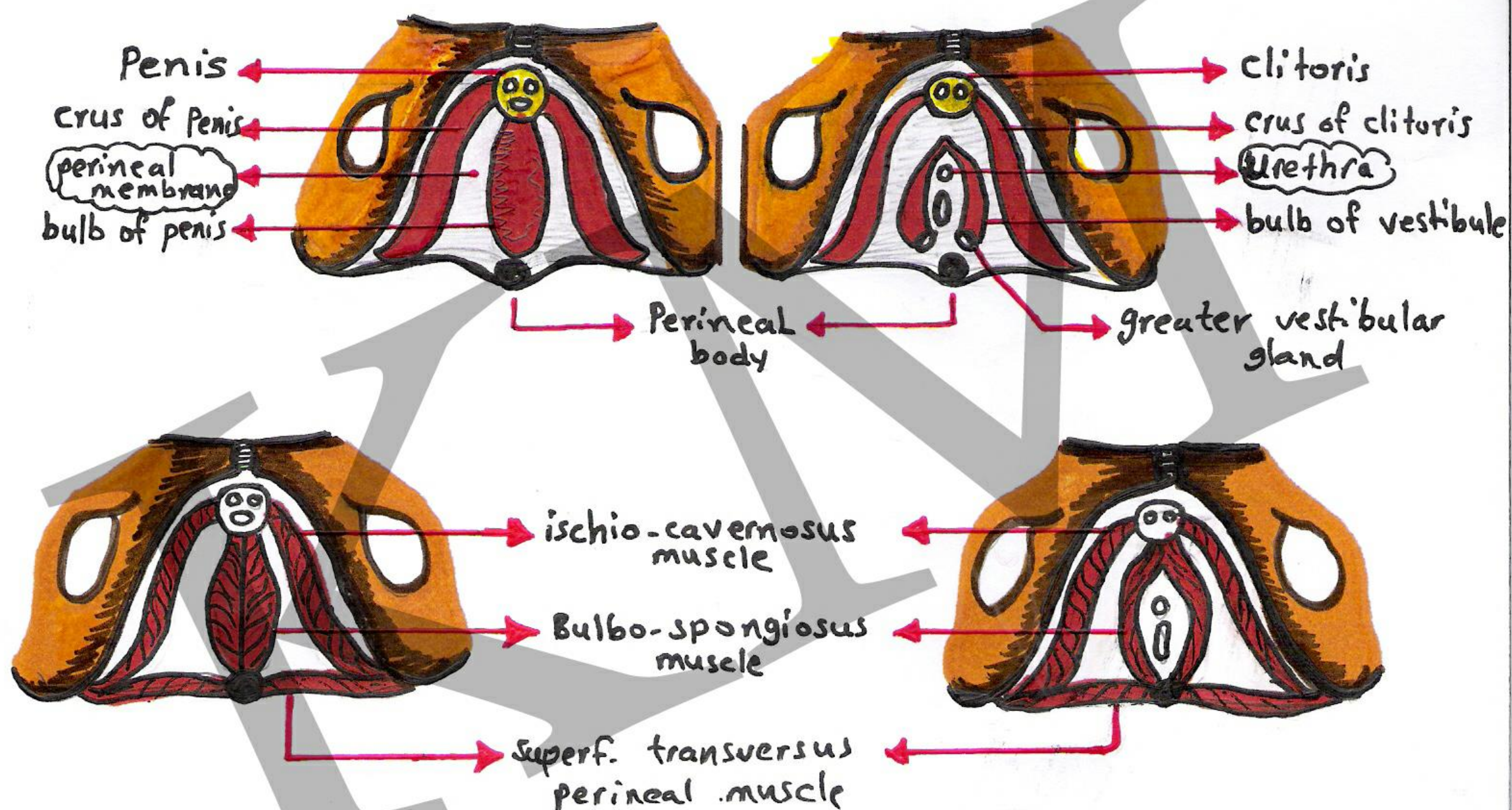
- * Boundaries :-
- Superior:- perineal membrane.
 - Inferior:- membr. layer of superf. fascia.
 - Lateral:- pubic arch.

- * Contents :-
- (Male) :- ① root of penis (bulb & 2 crura)
 ② superficial perineal muscles (see later).
- (Female) :- ① bulbs of vestibule & crura of clitoris.
 ② superficial perineal ms (see later).

N.B. :- Bulbs of vestibule lie one on each side of the vaginal orifice.

- superficial perineal muscles are :-

- ① superficial transversus perineal ms.
- ② Ischio-cavernosus ms.
- ③ Bulbo-spongiosus ms.



DEEP PERINEAL POUCH:

- It is completely closed space.

*Boundaries:- superior:- pelvic fascia.

- inferior:- perineal membrane.

- Lateral:- Pubic arch.

*Contents:-

IN MALE ♂	IN FEMALE ♀
① Bulbo-urethral gland	① vagina.
② Urethra (membranous part)	② Urethra.
③ Urethral sphincters ms (external & internal)	③ Urethral sphincters
④ Deep transv. perineal ms	④ Deep transv. perineal ms
⑤ Bulb vessels	⑤ Bulb vessels.
⑥ Internal pudendal vessels	⑥ Int. pudendal vessels.
⑦ Dorsal nerve of penis	⑦ Dorsal N. of clitoris.

[NB: ③ & ④ Don't pierce perineal membr. & the rest pierce it]

*Structures piercing perineal membrane:-

(MALE):- ① Duct of bulbourethral gland.

② urethra.

③ Bulb vessels

④ Int. pudendal vessels.

⑤ Dorsal N. of penis

(FEMALE):- ① vagina.

② urethra.

③ Bulb vessels

④ int. pud. vessels.

⑤ Dorsal N. of clitoris.

NB • UROGENITAL DIAPHRAGM:-

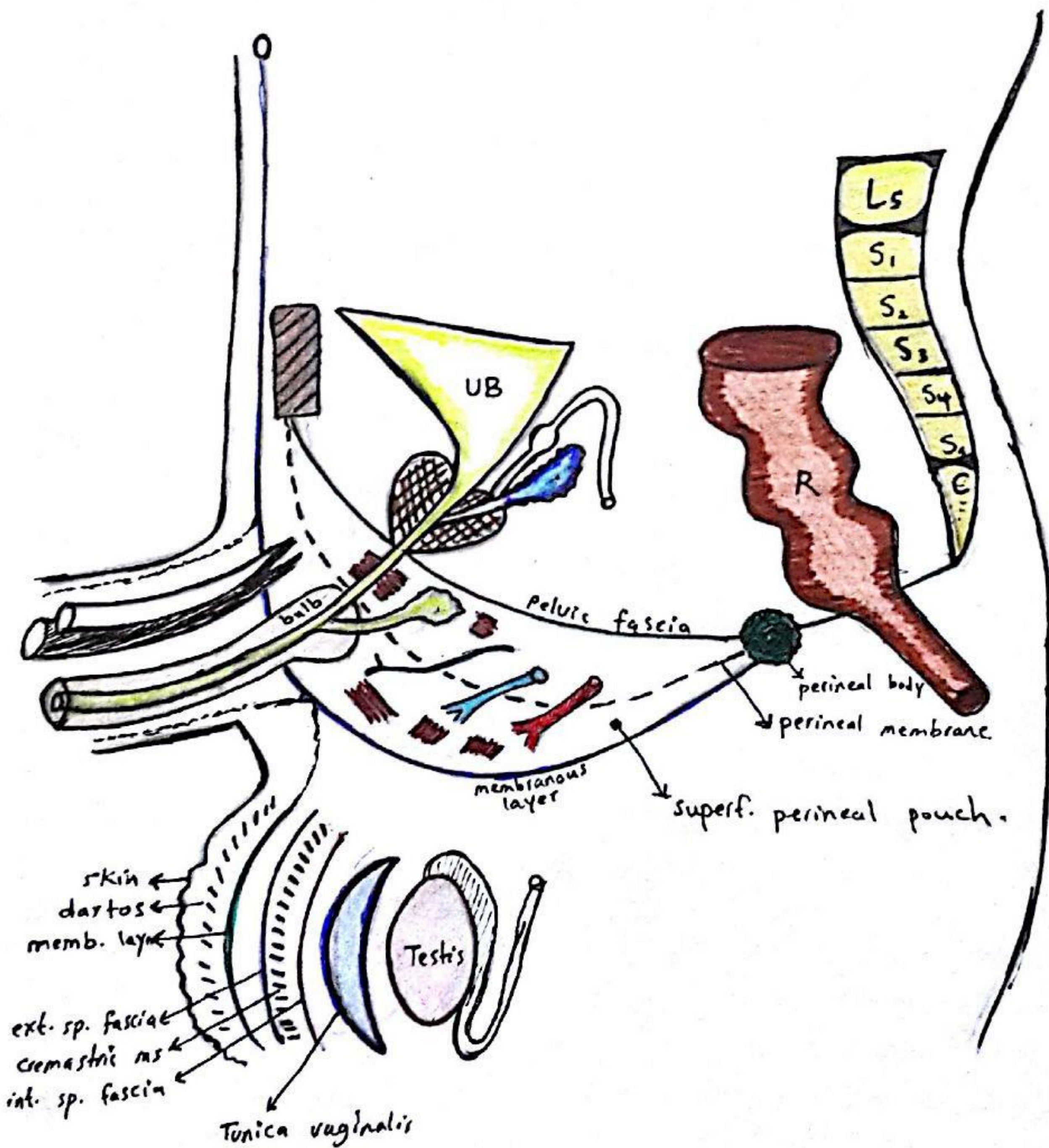
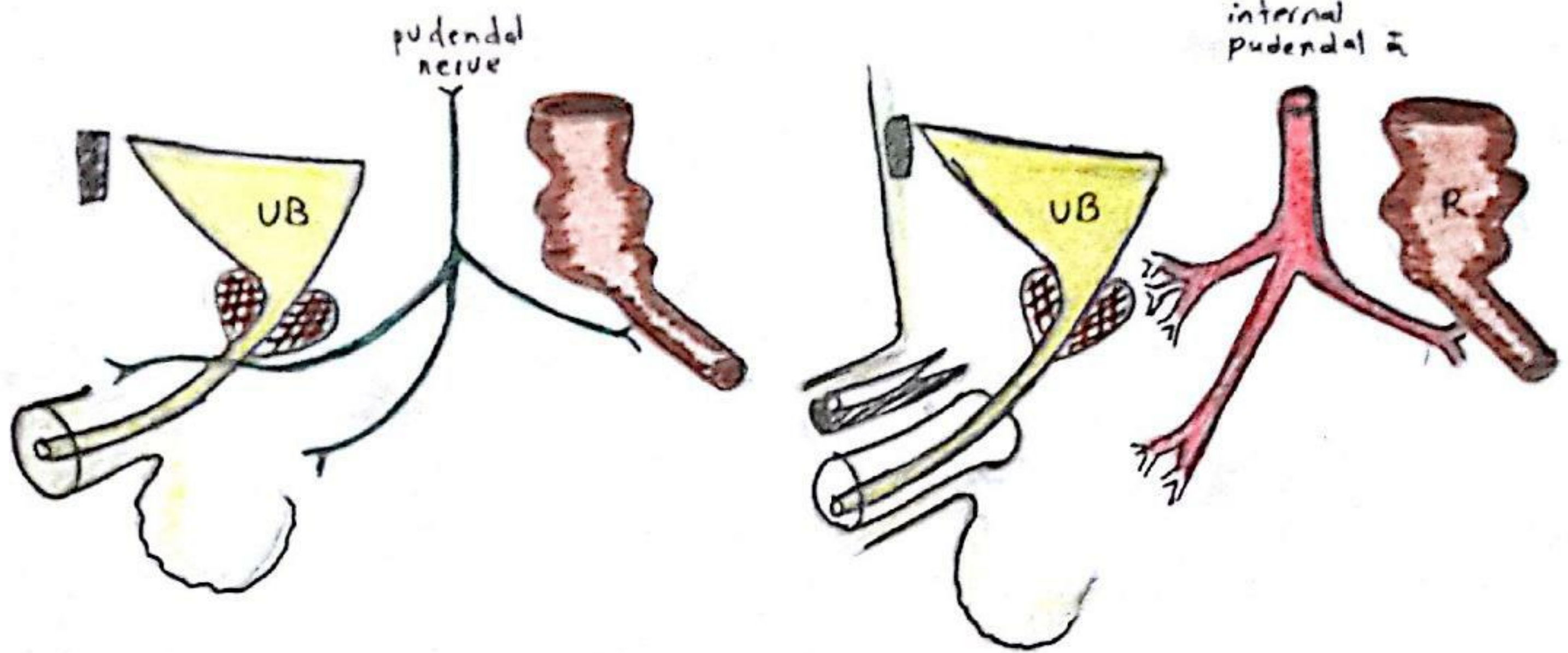
- Is a triangular musculo-fascial diaphragm situated in the anterior part of perineum (in gap of pubic arch)

- it is formed by urethral sphincters & deep transv. perineal ms, which are enclosed bet. superior & inferior layers of fascia of the urogenital diaphragm.

• PERINEAL MEMBRANE:-

- Is the inferior layer of fascia covering urogenital diaphragm.

- NB:- the superior layer is continuous as pelvic fascia, so the space between superior layer (pelvic fascia) and the inferior layer (perineal membrane) becomes deep perineal pouch.



"UROGENITAL TRIANGLE"

PENIS - consists of :-

- ① **Root** :- (fixed) :- (a) Bulb (b) two crura. (Rt & Lt).
- ② **Body** :- (hangs) :- (a) Corpus spongiosum. (b) corpora cavernosa (two).

1- ROOT OF PENIS

* **Bulb** :- (traversed by urethra)

- attached to undersurface of the urogenital diaphragm.
- Covered by bulbospongiosus ms
- Continued anteriorly into the body of penis as Corpus spongiosum.

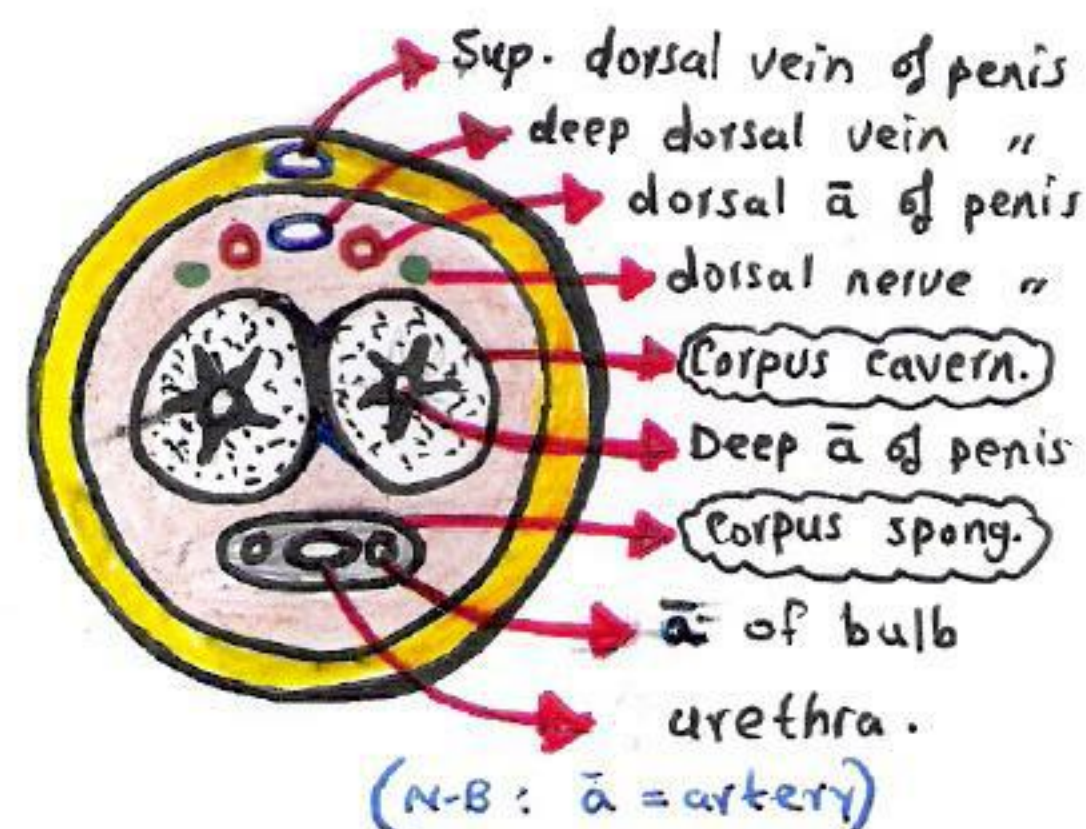
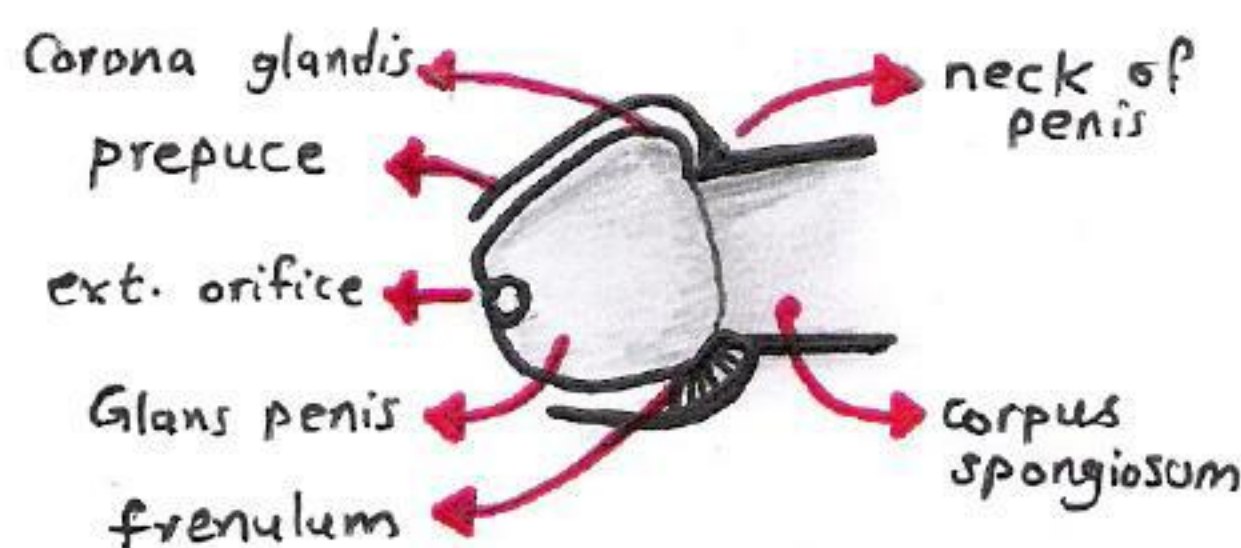
* **Crura** :- (right & Lt crus).

- attached to sides of pubic arch.
- Covered by ischio cavernosus ms.
- Continued anteriorly into the body of penis (dorsal to corpus spongiosum) to form corpora cavernosa.



2- BODY OF PENIS

- It is mainly composed of three erectile bodies (two corpora cavernosa dorsally & corpus spongiosum ventrally) enclosed in tubular sheath of fascia (Buck's fascia).
- The distal expanded end of corpus spongiosum forms Glans penis which is covered by Prepuce or foreskin that is connected to Glans penis under the urethra by a fold called Frenulum.
- Ligaments of penis are :-



- ① **Suspensory lig** :- from the front of symphysis pubis to dorsum of penis.
 - ② **Fundiform lig** :- from linea alba & surround penis like a sling.
- (Both ligaments are a condensation of deep fascia)

* Blood supply of penis:-

- Arteries (branches of internal pudendal a):-
 - 1- Dorsal a of penis.
 - 2- Deep a of penis (inside corpora cavernosa).
 - 3- Artery of bulb of penis (inside corpus spongiosum).
- Veins drain into internal pudenda veins.

* Lymphatic drainage:-

- Skin of penis → into medial group of superficial inguinal LN.
- Deep structures → into internal iliac LN.

* Nerve supply:-

- Pudendal nerve & pelvic plexuses.

SCROTUM:-

- It is an outpouching of lower part of ant. abd. wall.
- Contains: testes, epididymis & lower end of spermatic cord.
- Layers are:-
 - ① skin
 - ② superficial fascia-(Dartos ms): replace fatty layer & Colles F. (membranous layer) continuation of scarp's
 - ③ ext. spermatic fascia:- derived from ext. oblique
 - ④ cremasteric ms & fascia:- " " int. "
 - ⑤ int. spermatic fascia:- " " fascia transversalis
 - ⑥ Tunica vaginalis. covers ant. & sides of testis.
- Blood supply
 - ① scrotal branches of int. pudendal a.
 - ② external pudendal (branches of femoral a).
- Lymph drain: into medial group of superficial inguinal LN.
- Nerve supply:
 - ① Anterior surface:- by:
 - ilioinguinal Nerve.
 - Genital br. of genitofemoral N.
 - ② posterior surface: by:
 - scrotal branches of perineal N.
 - scrotal br. of post. cut. N. of thigh.

* N.B: branches of internal pudendal artery are:-

- ① inferior rectal a.
- ② Dorsal a of penis (or clitoris)
- ③ Deep a of penis (or clitoris)
- ④ Artery of the bulb.
- ⑤ Two scrotal (or labial) arteries.

CLITORIS :

- Resembles the penis in appearance & structure but is not traversed by the urethra. , Lies at apex of vestibule (ant.)
- Consists of root & body.

(1) ROOT OF CLITORIS :- (see penis)

- Bulb of vestibule :- divided into 2 halves by vagina.
- Crura of clitoris :- continue as corpora cavernosa anteriorly.

(2) BODY OF CLITORIS :-

- Corpora cavernosa (two)
 - Corpus spongiosum represented by small amount of erectile tissue leading from vestibular bulbs to glans.
 - Glans of clitoris :- is a small mass of erectile tissue that caps the body & partly hidden by the prepuce and contain numerous sensory endings.
- Blood, nerve supply & lymph drain → as penis.

VULVA :

- Vulva is the female external genital organs & consists of:

- ① Mons pubis :- collection of fat over pubis & covered by hair
- ② Labia majora :- pair of skin fold enclosing a space in between them called pudendal cleft.
- ③ Labia minora :- pair of skin fold bet. majora.
- ④ clitoris :- discussed before. (Glans ④ & Prepuce ⑥)
- ⑤ Vestibule :- space bet. two minora into which opens the urethra & vagina.
- ⑥ urethral opening (in front of vaginal orifice)
- ⑦ Vaginal orifice :- partially closed by hymen in Virgins.

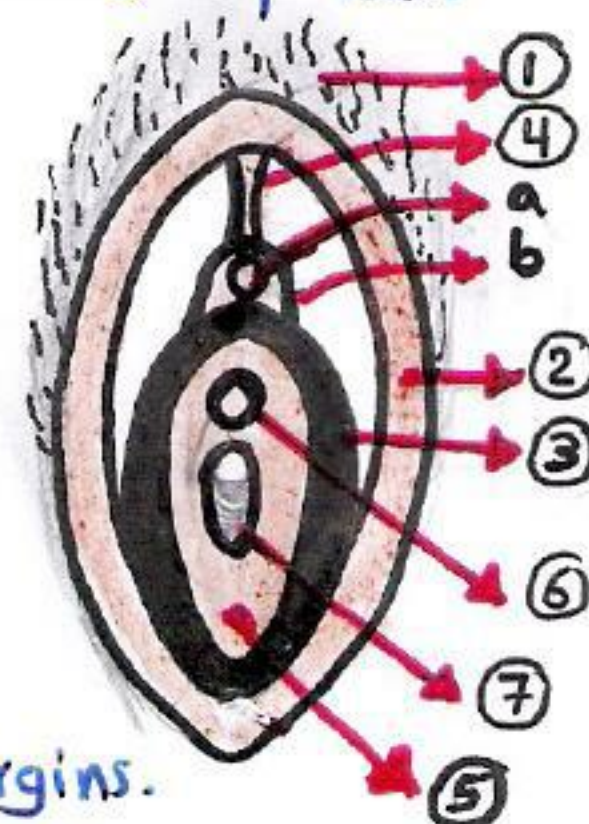


Table Muscles of the Pelvic Walls and Floor

Name of Muscle	Origin	Insertion	Nerve Supply	Action
Piriformis	Front of sacrum	Greater trochanter of femur	Sacral plexus	Lateral rotator of femur at hip joint
Obturator internus	Obturator membrane and adjoining part of hip bone	Greater trochanter of femur	Nerve to obturator internus from sacral plexus	Lateral rotator of femur at hip joint
Levator ani	Body of pubis, fascia of obturator internus, spine of ischium	Perineal body, anococcygeal body, walls of prostate, vagina, rectum, and anal canal	Fourth sacral nerve, pudendal nerve	Supports pelvic viscera; sphincter to anorectal junction and vagina
Coccygeus	Spine of ischium	Lower end of sacrum; coccyx	Fourth and fifth sacral nerve	Assists levator ani to support pelvic viscera; flexes coccyx

Table Muscles of Perineum

Muscle	Origin	Insertion	Nerve Supply	Action
External anal sphincter				
Subcutaneous part	Encircles anal canal, no bony attachments			
Superficial part	Perineal body	Coccyx	Inferior rectal nerve and perineal branch of fourth sacral nerve	Together with puborectalis muscle forms voluntary sphincter of anal canal
Deep part	Encircles anal canal, no bony attachments			
Puborectalis (part of levator ani)	Pubic bones	Sling around junction of rectum and anal canal	Perineal branch of fourth sacral nerve and from perineal branch of pudendal nerve	Together with external anal sphincter forms voluntary sphincter for anal canal
Male Urogenital Muscles				
Bulbospongiosus	Perineal body	Fascia of bulb of penis and corpus spongiosum and cavernosum	Perineal branch of pudendal nerve	Compresses urethra and assists in erection of penis
Ischiocavernosus	Ischial tuberosity	Fascia covering corpus cavernosum	Perineal branch of pudendal nerve	Assists in erection of penis
Sphincter urethrae	Pubic arch	Surrounds urethra	Perineal branch of pudendal nerve	Voluntary sphincter of urethra
Superficial transverse perineal muscle	Ischial tuberosity	Perineal body	Perineal branch of pudendal nerve	Fixes perineal body
Deep transverse perineal muscle	Ischial ramus	Perineal body	Perineal branch of pudendal nerve	Fixes perineal body
Female Urogenital Muscles				
Bulbospongiosus	Perineal body	Fascia of corpus cavernosum	Perineal branch of pudendal nerve	Sphincter of vagina and assists in erection of clitoris
Ischiocavernosus	Ischial tuberosity	Fascia covering corpus cavernosum	Perineal branch of pudendal nerve	Causes erection of clitoris
Sphincter urethrae	Same as in male			
Superficial transverse perineal muscle	Same as in male			
Deep transverse perineal muscle	Same as in male			

CLINICAL NOTES

* PER-RECTAL EXAMINATION (P/R):-

- Rectal exam. by gloved index finger may feel :-

[A] Posteriorly :-

- Sacrum, coccyx and anococcygeal body.

[B] Laterally :-

- Ischiorectal foss & ischial spine.

[C] Anteriorly :-

① opposite the terminal phalanx :-

[Male] 1- Rectovesical pouch

2- bladder (post surface)

3- Seminal vesicle & vas def.

[Female] 1- Rectouterine pouch.

2- Vagina.

3- Cervix

② opposite the Middle phalanx :-

[Male] 1- Prostate.

2- Recto-prostatic fascia.

[Female] 1- Vagina.

2- urogenital diaphragm.

③ opposite the proximal phalanx :-

[Male] 1- Perineal body.

2- urogenital diaphragm.

3- Bulb of penis.

[Female] 1- Perineal body.

2- Vagina (lower part).

* ANAL FISSURE :-

- Very painful longitudinal ulcer of anal valves.
- Usually caused by chronic constipation.
- Commonly occurs in midline posteriorly.

* PERI-ANAL ABSCESS :-

- Perianal (ischioirectal) abscess is accumulation of pus inside ischioirectal fossa due to infection.

* HEMORRHOIDS (PILES):

- It is a varicosities of tributaries of superior or inferior rectal vein & accordingly it is divided into:-

① Internal hemorrhoids:-

- Varicosities in tributaries of superior rectal (hemorrhoidal) vein.
- Covered by mucous membrane, in upper $\frac{1}{2}$ of anal canal.
- Sensitive only to stretch (aching pain) because innervated by autonomic afferent nerves.
- Occurs at 3, 7 & 11 o'clock position in lithotomy position (supine position with both hips flexed & abducted).

② External hemorrhoids:-

- Varicosities in tributaries of inferior rectal (hemorrhoidal) vein.
- Covered by mucous membrane of lower $\frac{1}{2}$ or by skin.
- Sensitive to (Pain, Touch, Temp. & Pressure) i.e. Painful because innervated by somatic (inferior rectal nerve).
- Commonly associated with advanced internal hemorrhoids.



- End of perineum

- My best wishes

- Dr. KM.

2023-2024